SIXTH ANNUAL FUEL CONSERVATION NUMBER

S 21 '21

The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

Vol. XVIII. No. 9
$2.00 a year 20 cents a copy

SEPTEMBER, 1921

New York Office, 1123 Broadway
Published at Cooperstown, N. Y.

FUEL OIL

The RIC-WIL METHOD of retaining the fluidity necessary for the economical transmission of heavy oils through underground pipes is clean cut, complete and ruggedly practical.

THE RIC-WIL COMPANY
CLEVELAND
OHIO

Illustration shows size 18 inch conduit, 6 inch oil supply pipe, 3 inch oil supply pipe on top spindle, with 2½ inch steam pipe below to furnish heat to keep the former warm. Supported and protected by RIC-WIL interlocking base drain.

Send for a copy of Bulletin No. 1 which contains complete description of materials, blue prints showing typical installations and other valuable information regarding underground pipe construction.

Agents in

Boston
Chicago
Detroit
Grand Rapids
Houston
Indianapolis
Kansas City
Minneapolis
Nashville
New York
Philadelphia
Pittsburgh
Rochester
Saginaw
St. Louis
Washington

Canada

Montreal
St. John
Toronto
Winnipeg

CLARAGE

KALAMAZOO

BLOWERS-FANS-ENGINES

Architects and Engineers:
Warren & Wetmore
New York City

General Contractors:
Thompson-Starrett Co.
New York City

STRAUS BUILDING
Fifth Avenue at 46th Street

Equipped with Clarage-Kalamazoo Multiblade Fans

New Yorkers talk of Fifth Avenue between Forty-second and Fifty-ninth streets as "the new financial district." The most recent addition to this rapidly growing investment section is the Straus Building, the finist private banking institution in the world. The building is indeed a rare combination of beauty and utility—an artistic asset which possesses every convenience for health and comfort.

One admirable feature is the ventilating system in which CLARAGE-KALAMAZOO MULTIBLADE FANS are used. Day in and day out, winter and summer, the occupants of the Straus Building are assured an abundance of good, clean, pure air.

SEE OUR CATALOGUE IN SWEET'S

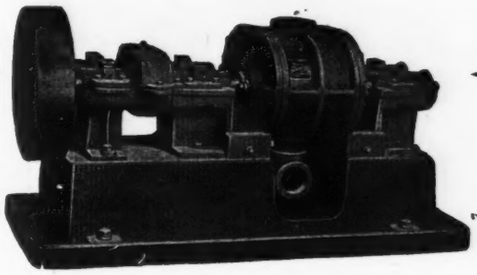
Clarage equipment is used for ventilating and heating industrial plants and public buildings of all kinds. For your convenience in securing ready information about our products, we are represented in Sweet's Catalogue. Detailed information is found in our catalogue 51. Send for it today!

CLARAGE FAN COMPANY

414-420 Porter Street, Kalamazoo, Michigan

Manufacturers of Fans, Blowers, Heaters, Engines

Economy



Service

Economy in a vacuum heating system is determined to a greater extent by service than by first cost. Users of Connersville Vacuum Pumps have found that with little attention they continue to run year after year, giving the same dependable service, each succeeding season.

The Connersville Blower Company

Connersville Indiana U.S.A.

Chicago, Monadnock Block New York, 114 Liberty Street

Marsh Reflux Junior Thermostatic Traps

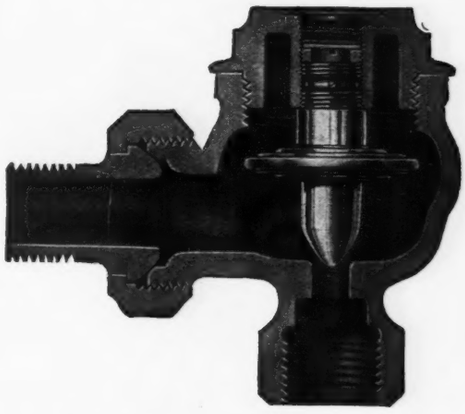
For Radiators and Coils of "Low Pressure," "Vapor" and "Vacuum Heating Systems"

FREELY DISCHARGES AIR AND WATER WITHOUT LOSS OF STEAM

THE Marsh REFLUX Return Line Trap is for use on the return end of radiators of low pressure, vapor or vacuum systems of heating. It is the result of a careful investigation into the actual requirements that must be fulfilled by a radiator return valve, in order that it may accomplish what is desired of it, namely, to **free the radiator of air and water without the loss of steam** and to do so **noiselessly.**

The Marsh Reflux Junior Thermostatic Trap is recommended for small radiators and coils. This Trap for the small and the Original Reflux for the large units will make an ideal job. Especially adaptable for two pipe gravity work and vapor systems.

May be furnished either sealed adjustment (as illustrated) or with outside adjustment.



Write for literature fully describing this Trap

JAS. P. MARSH & CO., 118-124 South Clinton Street, Chicago

Founded 1865

Manufacturers of Gauges for all Pressures **Automatic Air Valves and Steam Specialties**

Agents for Great Britain and Ireland: Chatterton & Co., 30 Fetter Lane, E. C. 4, London
Agents for Dominion of Canada: Taylor-Forbes Co., Ltd., Guelph, Ontario

Mr. Heating Contractor

Do you know that we are approaching a severe winter and that you can do a mighty profitable business this fall selling and installing

BARBER PATENTED GAS BURNERS

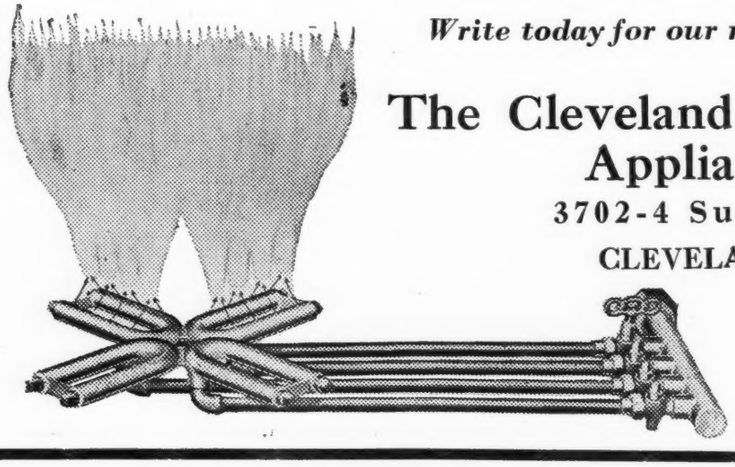
for NATURAL and ARTIFICIAL GAS

for FURNACES, STEAM and HOT WATER BOILERS

also for hundreds of industrial uses, including—

Bake Ovens	French Ranges	Lehring Furnaces
Boilers, High Pressure	Galvanizing Tanks	Metal Tanks
Candy Stoves	Garage Heaters	Peanut Roasters
Clothes Pressing Boilers	Gas Radiators	Plating Tanks
Coffee Roasters	Gas Steam Radiators	Popcorn Roasters
Coffee Urns	Heating Stoves (coal)	Radiant Heaters
Core Ovens	Hot Plates	Refrigerating Equipment
Doughnut Stoves	Hot Water Heaters	Room Heaters
Drying Ovens	Incinerators	Steam Generators
Enamelling Ovens	Ironing Machines	Steam Tables
Fire Grates	Kitchen Ranges	Sterilizers
Floor Heaters	Laundry Pressing Equipment	Vulcanizing Boilers

All sizes, all shapes, to suit every purpose. Your clients want the highest efficiency at the lowest cost. Our gas burners develop 100% heat and save from 25% to 40% in gas.



Write today for our new catalog and prices

The Cleveland Gas Burner & Appliance Co.

3702-4 Superior Ave.

CLEVELAND, OHIO

KEWANEE

Goes into Building in One Piece

When the boiler room is planned be sure there is sufficient floor space for the Kewanee Boiler. And if the boiler is to be installed *after* the walls are up *be sure an opening is left which is large enough to get the boiler into the basement.*

You can't get a 48-inch boiler through a 36-inch wall opening—Nope, it can't be done by anyone.

Remember a Kewanee Boiler arrives on the job in one piece. It can't be "knocked down" or taken apart. It is solidly riveted together before it leaves our factory. It must have sufficient floor space, and an opening must be left big enough to get it into the building.

Every Architect and Heating Contractor has a copy of our Catalog No. 76 which gives complete specifications and measurements of all sizes of Kewanee Firebox Boilers. If yours has been mislaid write, wire, phone for another.

KEWANEE BOILER COMPANY

KEWANEE, ILLINOIS

Steel Heating Boilers, Radiators, Tanks, Water Heating Garbage Burners

BRANCHES:

CHICAGO	Market & Washington Sts.	ST. LOUIS	1212 Chemical Bldg.	PITTSBURGH	945 Oliver Bldg.
NEW YORK	47 W. 42nd St.	MINNEAPOLIS	708 Builders Exchange	DALLAS	Southwestern Life Bldg.
DES MOINES	315 Hubbell Bldg.	WASHINGTON, D.C.	534 Southern Bldg.	DETROIT	1925 Ford Bldg.
KANSAS CITY	2014 Wyandotte St.	SALT LAKE CITY	Scott Bldg.	TOLEDO	629 Nicholas Bldg.
INDIANAPOLIS	509 Occidental Bldg.	MILWAUKEE	Mer. & Mfrs. Bank Bldg.	CLEVELAND	706 Rose Bldg.

CANADIAN REPRESENTATIVES—The Dominion Radiator Co., Ltd.
Toronto, Ont., Montreal, Que., Winnipeg, Man., Hamilton, Ont., St. John, N. B., Calgary, Alta., Vancouver, B. C.

Read this Experience

Notary Public

Abstracts Examined

WE BUY AND SELL CHICAGO REAL ESTATE

EDWIN J. EVANS & CO.

LOANS - REAL ESTATE - INSURANCE

4324 Berkeley Avenue

Just South of 43rd Street

All Telephones Oakland 1733

Chicago August 10th, 1921.

Herbert Boiler Co.
Root & La Salle Sts.
Chicago.

Gentlemen:—Replying to your enquiry as to the efficiency of the Herbert Magazine Water Tube Boiler you furnished me in the fall of 1918, I say that the cast iron Boiler made by the highest class firm burned over 100 tons of the best Coal in underfeeding my Buildings, your Boiler consumed 60 tons of the lowest grade coal and overheated the same properties. (This Cast Iron Boiler was installed new in 1914)

The matter of efficiency is self-evident.

The amount of attention your Boiler requires in operation is so small as to be almost unbelievable, the consuming of waste can be removed once each season.

In conclusion I must say your Boiler functions perfectly in every way, furnishes Steam at the lowest possible minimum of Cost.

Faithfully Yours.

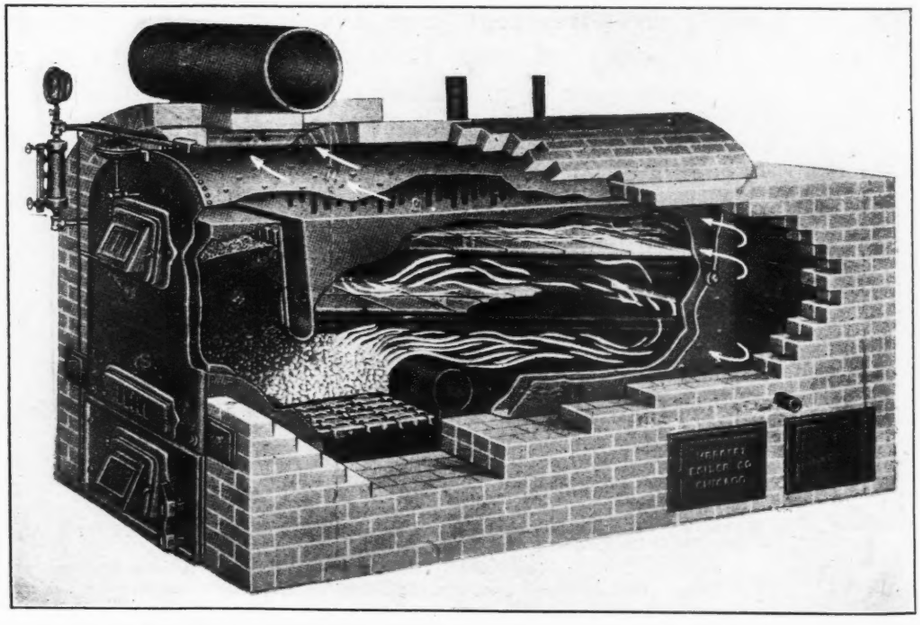
Edwin J. Evans.

HERBERT BOILERS

MAKE GOOD

The boiler referred to in this letter is heating six two-story dwellings which were turned into apartments, and six garages on the rear of the lots, with a distance of 75 ft. between the garages and the building where the boiler is set, making a total of about 3500 sq. ft. of actual radiation, without counting the mains and returns between the garages and the building proper, amounting to 200 sq. ft. of additional radiation.

Herbert Boilers combine the down-draft feature with the direct draft and dispense with the objectionable parts of both. Will carry steam for 10 or 12 hours without attention. Burns any kind of fuel from Buffalo Chips to Hard Coal.



Herbert Boiler Co.
Root and La Salle Sts.
CHICAGO, ILL.

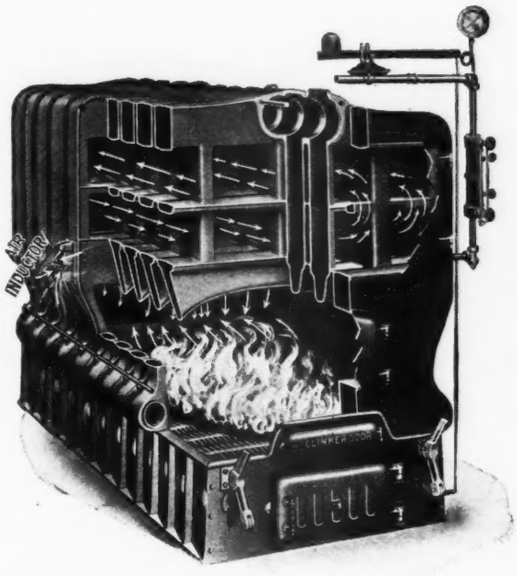
Monarch
Up-Draft Smokeless Boiler

"The Distinguished Service Line"

Burns Soft Coal, Hard Coal or Coke

Smoke is Wasted Fuel

THERE is an increasing demand for a heating boiler that will burn soft or bituminous coal **without smoke.** This demand has been brought about by the increased use of soft coal, due to the high cost or inadequate supply of hard or anthracite coal.



No. S-40-12 Monarch Up-Draft Smokeless Boiler

Cutaway View showing Fire Travel, Air Inductor and Primary and Secondary Combustion Chambers

The emission of smoke is a sure indication of imperfect combustion, showing that the rich gases from the products of combustion are not being thoroughly consumed, escaping unburned up the chimney, as is evidenced where soft coal is burned in the ordinary boiler, it being impractical in such types to supply the rapidly liberated gases with sufficient air through the grate to ignite and consume them thoroughly, resulting in a large percentage of the fuel being wasted, going forth in form of smoke, injurious to health, the building and surroundings, and this has compelled most cities and towns to adopt rigid anti-smoke ordinances.

The Monarch Up-Draft Smokeless Boiler is a single grate boiler. The products of combustion rise in the fire box, coming in contact with the valuable direct overhanging fire surface, thence passing to the rear or secondary combustion chamber where air from both sides of the boiler is admitted through the **air inductor** over the fuel bed, producing a mixture of proper proportions for complete combustion before the gases, now fully ignited, turn and pass through the lower tier of flues to the front of the boiler and back to the chimney through the upper tier, the heat units thereby released being absorbed by the heating surfaces of the flues, and all combustibles completely consumed before leaving the boiler, absolutely eliminating all smoke, even with the cheapest grades of soft coal.

The Monarch Up-Draft Smokeless Boiler not only burns any grade of soft coal smokelessly, but effects a **saving of 25% to 33⅓%** without the skilled care and excessive attention required in other constructions.

An important feature of this boiler is that the air passage through the section is an integral part of the section, completely surrounded by water; therefore, it cannot burn out. It is indestructible, and does not require renewal as in other boilers.

The Wm. H. Page Boiler Co.

NEW YORK	BOSTON	PHILADELPHIA	CLEVELAND
141 West 36th St.	379 Commercial St.	1718 Samson St.	Builders Exchange

FACTORY: Meadville, Pa.

MAKERS OF A COMPLETE LINE OF ROUND AND SQUARE BOILERS FOR EVERY CLASS OF BUILDING

The Arrows Tell Only Half the Story—

Perfect circulation of the water, as well as of the heated gases, is provided by the construction of

IMICO HEATING BOILERS

SMOKELESS

DOWN DRAFT

Vertically-inclined waterways and horizontal fire surfaces insure at all times quick separation of steam from water. **Each section has independent positive internal circulation.**

Special Machinery is Used to Secure Perfect Alignment of the Sections—a Feature not Possessed by Other Screw Connection Boilers

Catalogue describing our complete line of heating apparatus sent on request

ILLINOIS MALLEABLE IRON CO.

CHICAGO, ILLINOIS

LARGEST CONCRETE BUILDING
Uses Novelty Carburetor Boilers

For the new Hide & Leather Building, New York City, the largest concrete building in the world, the heating appliance selected was the Novelty Carburetor Boiler. Because of its quick heating, long firing periods, ease of operation, and its maintenance of the same pressure during coaling, this boiler was the logical choice. The Novelty Carburetor Boiler burns without smoke all grades of soft coal and any size of hard coal down to and including No. 1 Buckwheat. In the self-adjusting carburetor all smoke, gases, and carbon, ordinarily wasted, are mixed with oxygen from the air and ignited. So you get more heat and thus use less fuel. These are some of the reasons that have dictated the installation of Novelty Carburetor Boilers in every type of building north and south from coast to coast.

Now Advertised in the Saturday Evening Post

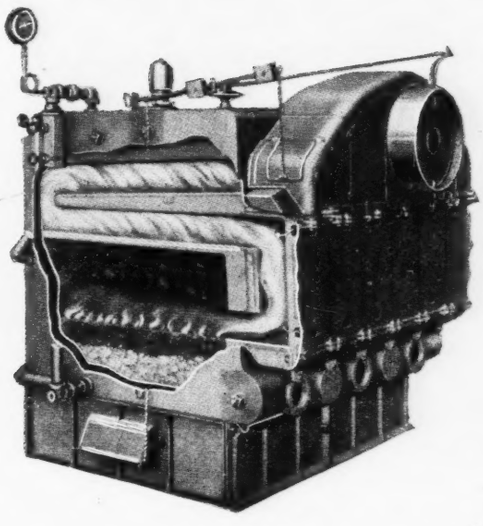
ABRAM COX STOVE COMPANY
American and Dauphin Sts, Philadelphia
736 W. Monroe St., Chicago—Bush Terminal, Bldg. No. 1, Brooklyn, N. Y.

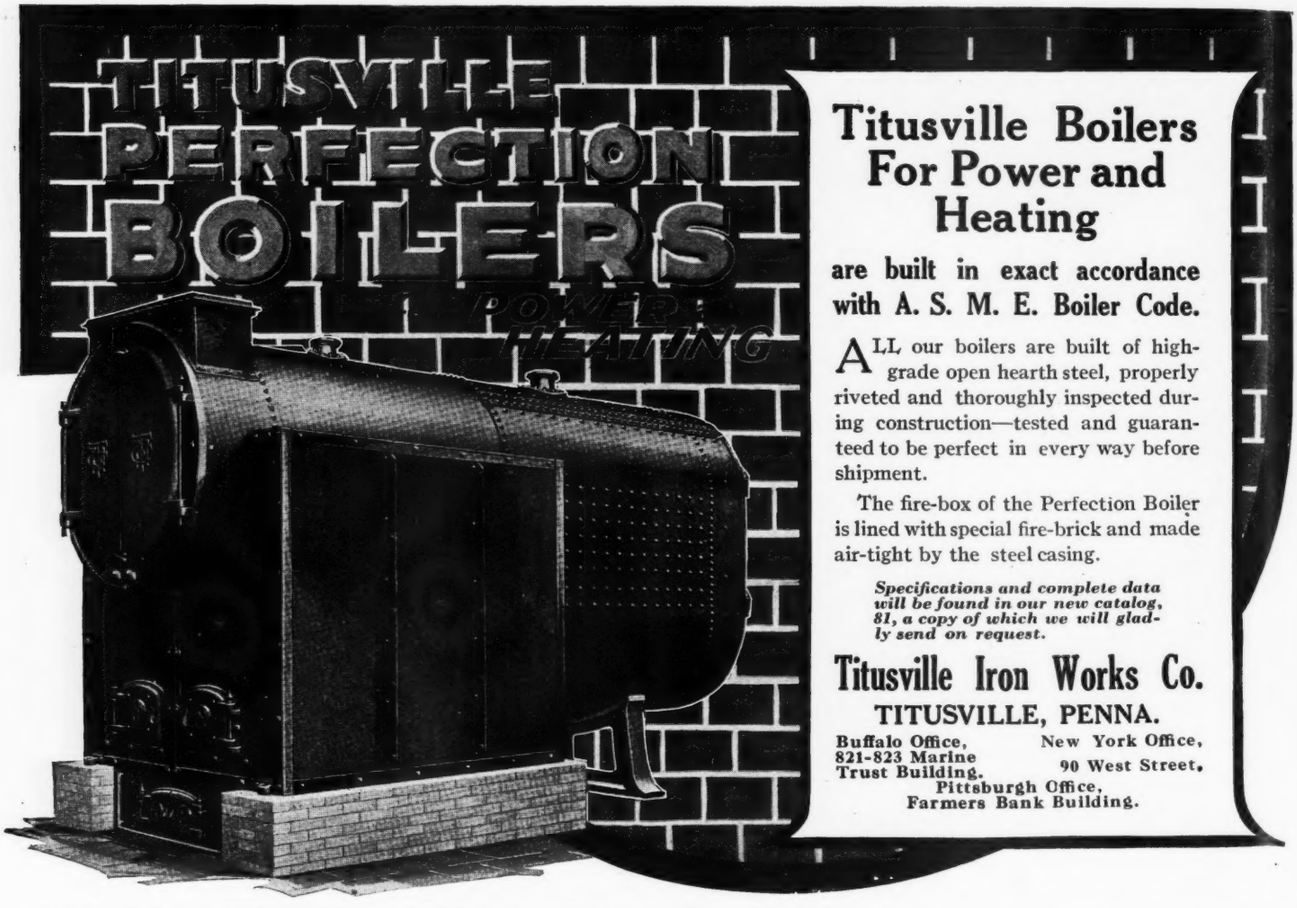
Heated with two No. 1240 Novelty Carburetor Boilers.

A cast iron, side-feed, updraft, low water line (52"), smokeless boiler. Made small enough for the home—large enough for theatres, office buildings, warehouses, and factories.

Write for full information today while you think of it

NOVELTY CARBURETOR BOILER





Titusville Boilers For Power and Heating

are built in exact accordance with A. S. M. E. Boiler Code.

ALL our boilers are built of high-grade open hearth steel, properly riveted and thoroughly inspected during construction—tested and guaranteed to be perfect in every way before shipment.

The fire-box of the Perfection Boiler is lined with special fire-brick and made air-tight by the steel casing.

Specifications and complete data will be found in our new catalog, 81, a copy of which we will gladly send on request.

Titusville Iron Works Co.

TITUSVILLE, PENNA.

Buffalo Office, 821-823 Marine Trust Building.

New York Office, 90 West Street.

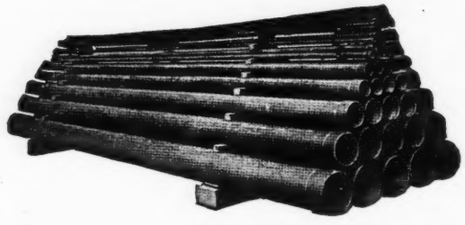
Pittsburgh Office, Farmers Bank Building.

JOHN SIMMONS CO

110 Center Street, New York

IRON AND STEEL PIPE—FITTINGS—VALVES

RAILWAY
MILL
and
FACTORY SUPPLIES

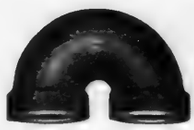


STEAM SPECIALTIES
FIRE PROTECTION
EQUIPMENT
FIRING TOOLS

Sole Distributors for this section of WM. POWELL CO.'S HIGH GRADE VALVES and DEPENDABLE ENGINEERING SPECIALTIES

PIPE COILS and BENDS — PLUMBING SUPPLIES

Special Literature Sent on Request



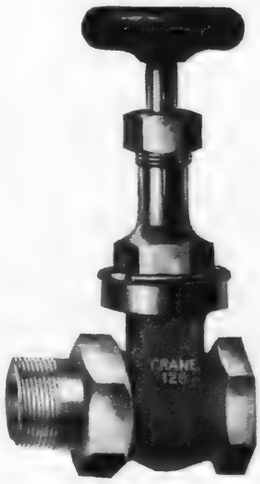
Suggestions for Factory Heating

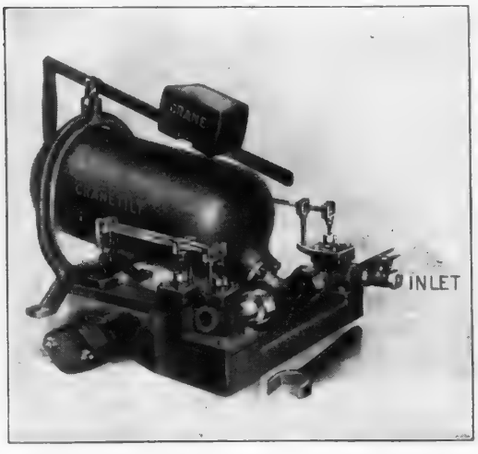
The heating apparatus of the modern factory is of prime importance. To produce the best results with reasonable economy requires the use of high-grade equipment. The

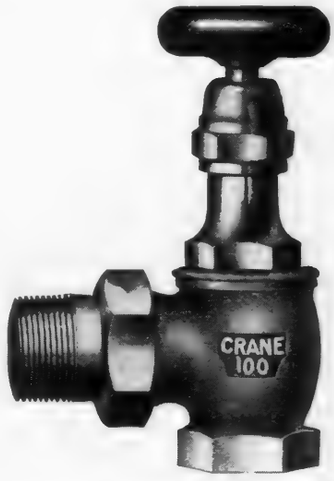
CRANE

line of products for heating is complete, and meets all requirements according to the best modern practice.

We are manufacturers of about 20,000 articles, including valves, pipe fittings and steam specialties, made of brass, iron, ferrosteel, cast steel and forged steel, in all sizes, for all pressures and all purposes and are distributors of pipe, heating and plumbing materials.







SALES OFFICES, WAREHOUSES AND SHOWROOMS:

BOSTON, SPRINGFIELD, HARTFORD, BRIDGEPORT, ROCHESTER, NEW YORK, HARLEM, ALBANY, BROOKLYN, PHILADELPHIA, READING, ATLANTIC CITY, NEWARK, CAMDEN, BALTIMORE, WASHINGTON, SYRACUSE, BUFFALO, SAVANNAH, ATLANTA, KNOXVILLE, BIRMINGHAM, MEMPHIS, LITTLE ROCK, MUSKOGEE, TULSA, OKLAHOMA CITY, WICHITA, ST. LOUIS, KANSAS CITY, TERRE HAUTE, CINCINNATI, INDIANAPOLIS, DETROIT, CHICAGO, ROCKFORD, OSHKOSH, GRAND RAPIDS, DAVENPORT, DES MOINES, OMAHA, SIOUX CITY, MANKATO, ST. PAUL, MINNEAPOLIS, WINONA, DULUTH, FARGO, WATERTOWN, ABERDEEN, GREAT FALLS, BILLINGS, SPOKANE, SEATTLE, TACOMA, PORTLAND, POCATELLO, SALT LAKE CITY, OGDEN, RENO, SACRAMENTO, OAKLAND, SAN FRANCISCO, LOS ANGELES

WORKS: CHICAGO AND BRIDGEPORT

FOUNDED BY R. T. CRANE, 1855

CRANE CO.

836 SO. MICHIGAN AVE.

CHICAGO

CRANE LIMITED — MONTREAL, TORONTO, VANCOUVER, WINNIPEG, CALGARY, REGINA, HALIFAX, OTTAWA

CRANE-BENNETT, LTD. — LONDON, ENG.

Figure it for yourself

Have you ever stopped to figure how much you could save by installing Economy Boilers which do not require expensive pipe headers?

Here is the 75-38 Economy Boiler rated at 3,900 sq. ft. direct steam radiation. Take another boiler of the same capacity. How much would it cost **You** to provide headers to insure dry steam?

Do away with pipe headers—install the Economy—you'll make more profit on every job.

INTERNATIONAL HEATER COMPANY
UTICA, N. Y.

BRANCHES:
New York Chicago Greensboro, N. C. Nashua, N. H.

SPENCER Magazine Feed HEATERS

NOW

When Your Customers are Thinking Seriously About Next Winter's Heating Problem, You Can Show Them How to Get Better Heat with Cheaper Coal

Your Customers will be more easily persuaded to buy their heating equipment through you if you can show them how they can save money.

The Spencer Heater will accomplish three things for them. It will successfully burn the cheaper, smaller sizes of hard coal (No. 1 Buckwheat) which cost much less than ordinary furnace coal. It will save from 30% to 40% of the fuel bill because of this lower cost of buckwheat. It will maintain a more even heat for longer periods and with less attention, because of the magazine which feeds automatically. Its magazine will take care of a twelve-hour supply in the coldest weather.

Successfully Burns No. 1 Buckwheat

But that is not all, and if you will get in touch with the office nearest you, you will give us an opportunity to show you all the Spencer advantages that will help make sales for you.

Standard Heater Company maintains offices in New York, Boston, Philadelphia, Buffalo, Detroit and Chicago.

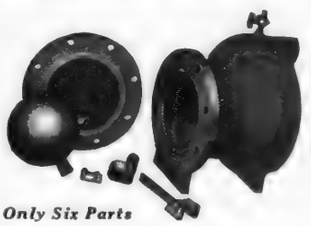
Write for the new Standard Heater book

STANDARD HEATER COMPANY
Williamsport, Pa.

How to Specify Steam Traps

Free copy of Specification and Data Sheet now ready, covers

CORLISS VALVE STEAM TRAPS



Only Six Parts

for
Power
Heating
Drips
Dryers
Pressure
Exhaust
Vacuum, Etc.

The Corliss Valve Steam Trap has the fewest parts; is positive in operation, and drains the lines continuously.

Sold with an Absolute Guarantee

There is a Corliss Valve Trap for every condensation removal service.

Send us your name and we will mail you data sheet.

PLANT ENGINEERING AND EQUIPMENT CO. INC.
192 Broadway New York, N. Y.
Chicago Boston Philadelphia Cleveland San Francisco

OZONE PURE AIRIFIER

The installation of the "Ozone Pure Airifier" in connection with Fan systems of heating and ventilation in schools, theaters, banks and manufacturing plants, permits of re-circulation of a large percentage of the total air volume handled.

A 25-Unit Equipment Ozone Pure Airifier.
Capable of ozonizing 25,000 cu. ft. of air per minute.

ADVANTAGES

Saving in Cost of Operation

1.—Reduction of 25 to 50% in coal consumption.

2.—Reduction in Steam Consumption.

Saving in initial Cost of Mechanical Equipment.

1.—Tempering coils may be omitted.

2.—Boiler capacity may be reduced.

3.—Sizes of steam and return pipes, valves, fittings and pumps may be reduced.

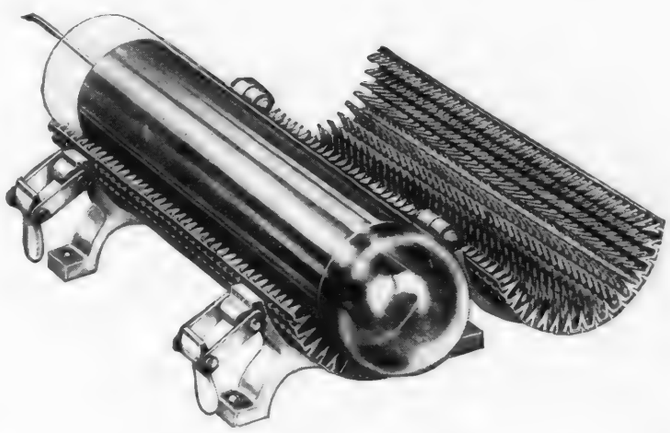
RESULTS

Pure air in rooms, free from organic odors and impurities.

The power consumed by the apparatus is extremely small, being only about 120 watts maximum for a 25,000 cu. ft. (per minute) machine when operating on alternating current. Based on an energy cost of 10c per kw. hr., this would give a cost of 12c per 10-hour day.

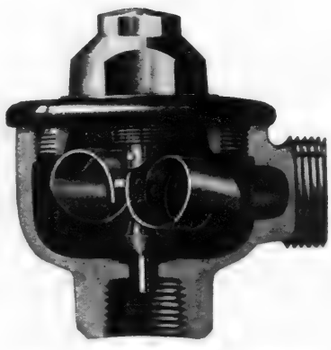
We will be pleased to send literature on this subject to anyone interested.

Ozone Pure Airifier Co.
1403 W. Jackson Blvd.
CHICAGO, ILL.

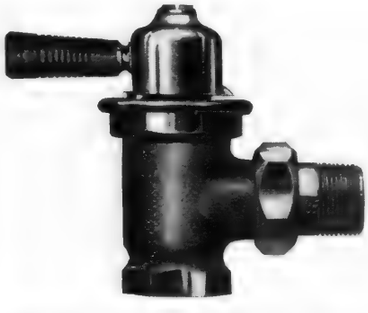


One complete unit capable of properly ozonizing 1000 cu. ft. of air per minute. The unit is shown open to illustrate simplicity of construction and ease of cleaning.

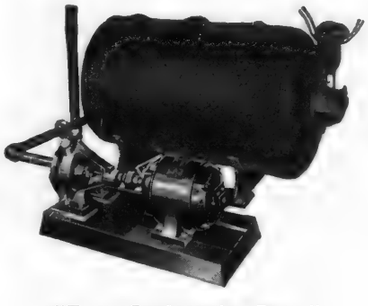
Business Builders



"The Trap Without a Diaphragm"



"The Trane Graduated Vapor Valve"



"Trane Condensation Pump"

THAT Trane Products, the Trane System of Vapor Heating and Trane Pumps are real business builders is amply proven by the experience of our customers with the expressed satisfaction of thousands of satisfied users in buildings of every description.

Equipped throughout with high grade heating specialties that have stood the real service tests for permanency and dependability, Trane Systems have established an enviable record for economical and efficient heating results.

Trane products are worth while builders of business good will, and they are backed by a valuable and nationally known engineering service that is always at your disposal. It will pay you to

Write for Bulletins today

The Trane Company

Established 1883

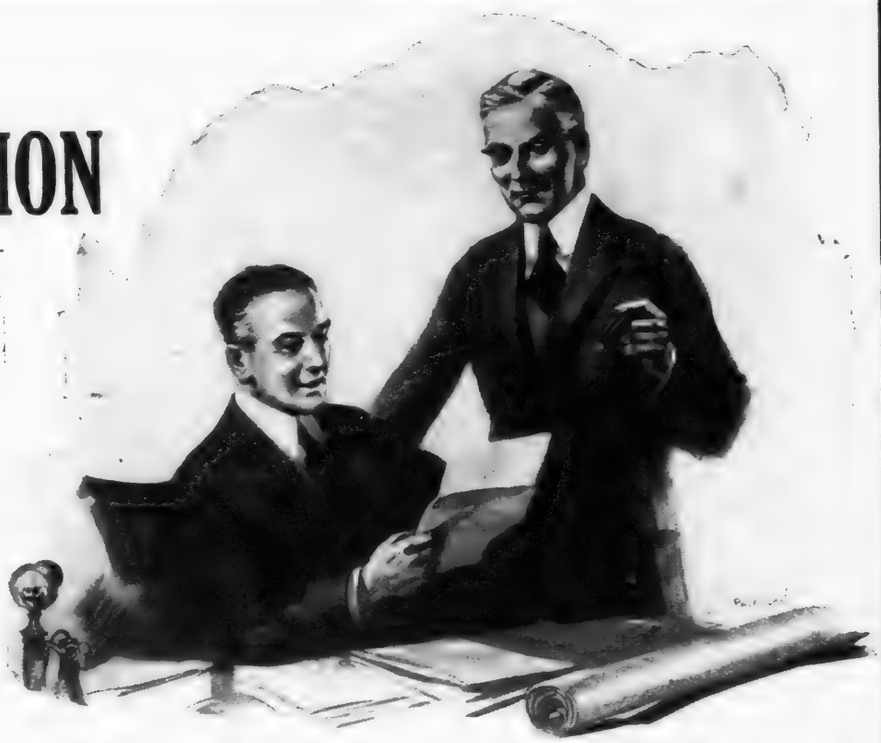
206 Cameron Ave. La Crosse, Wis.

Chicago New York Boston Philadelphia
Washington Buffalo Cleveland
Salt Lake City Portland, Ore.

LA CROSSE TRANE WISCONSIN

SOME SATISFACTION

WE HEREBY ACCEPT YOUR PROPOSAL

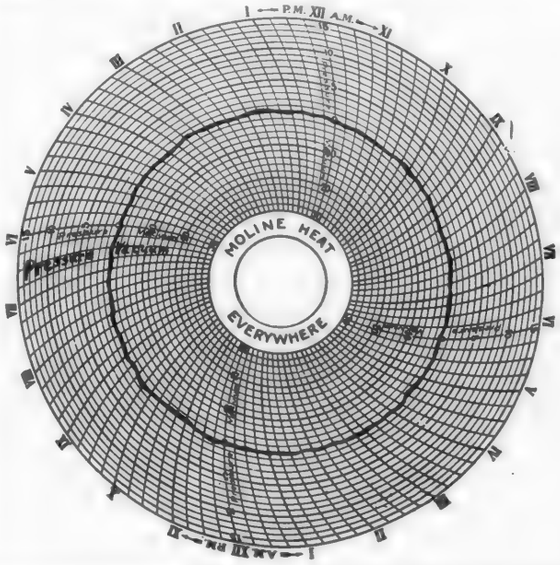


Yes, Mr. Heating Contractor, there's a lot of satisfaction when your proposal is accepted.

Did you ever try submitting a proposal on Moline Heat, Mr. Contractor? Thousands of you have done so, we know, and this advertisement is not directed to those who have had the satisfaction time and again of having their proposals on Moline Heat accepted—but to you who have not tried.

Have you read the Moline Heat Catalogs? Do you know the answer?

Are you still submitting proposals on the old methods of heating, ordinary steam systems that use leaky, sputtering airvents on radiators—or hot water systems with large, cumbersome pipes and radiators, and that are slow to respond? Or on systems that use automatic or thermostatic traps or other "jiggers" on the return ends of radiators and coils? If you are, well, you are going to change your mind some day—and you might as well do it now.



With Moline Heat no vacuum pumps are necessary to maintain circulation, no traps or any other get-out-of-order devices are necessary at the return end of the radiators—yet Moline Heat circulates steam through every radiator at a few ounces of pressure, no matter how large the job.

There is nothing that means so much to your business as profit. We know that—and so do you. Still, profit depends upon the satisfaction you give your customers. That is a fact that has been absolutely established. You cannot continue to satisfy your customers with old, antiquated methods—that's another fact.

Moline Heat works with natural laws, not against them, but you can't learn all about Moline Heat unless you study it. In fact, you should have experience. Many an old-time fitter and contractor has said, "I couldn't believe, I wouldn't believe it, until I tried it."

We want you to try two things—will you do it? Send in a set of plans on the next job you are figuring, then put in a bid on Moline Heat and see what happens—

When you get the job—yes, we said "get the job"—and have it installed, carefully note how it works, see what it does, don't just give it the "once over," but compare with any other system you ever saw or heard of. We know the answer now—you'll be one more addition to the host of Moline Heat Boosters.

If you haven't our catalogs, send for them today.

See Page 76

Moline Illinois

WRITE

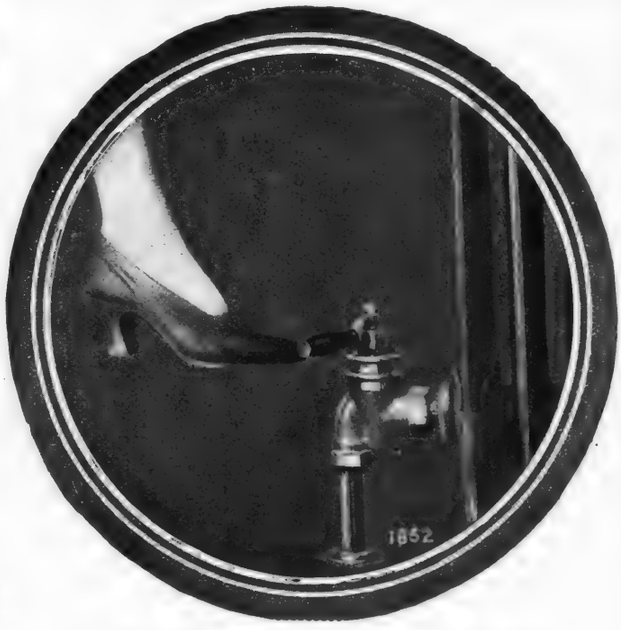
MOLINE HEAT
DEPT. F
Moline, Illinois

A Quarter Turn of the Handle Opens or Closes the

GORTON
QUICK-OPENING
VALVE

It moves with a touch of the foot or hand—quarter turn does the trick. Prevents opening a window to cool a room quickly (with resultant waste of steam and coal) for it is easier to operate the radiator with Gorton valve than it is to open windows.

There's a real saving for both your client and yourself in our suggestion that you write for full particulars.



No stooping. The slightest touch of the foot operates the valve.

Here are the Details of this Remarkable Valve

A. The valve with a packing lock—Acknowledged the best type of valve packing.

B. A ground ball shoulder fitting on a ground seat, Steam and water tight, and stays tight.

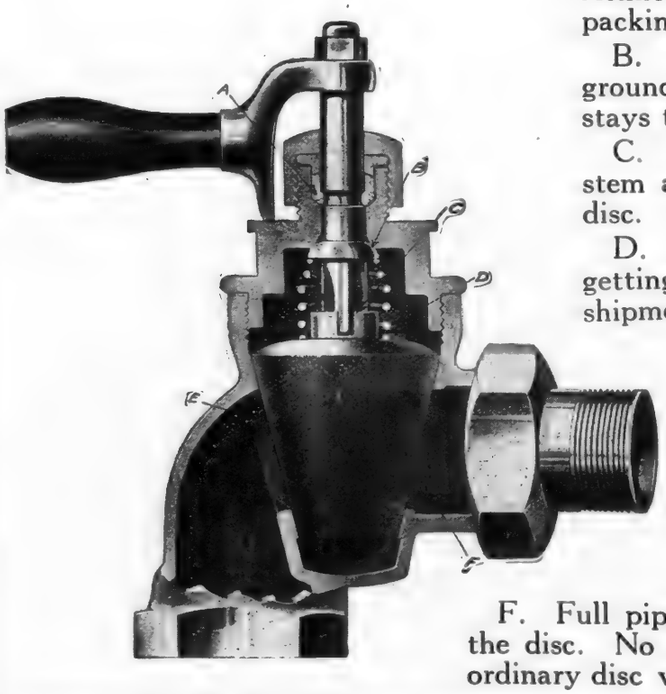
C. Loose joint connection between valve stem and disc—insuring perfect seating of disc.

D. Bronze spring prevents grit or dirt getting between disc and valve seat during shipment.

E. Mineral composition disc, no metal, sulphur nor rubber. Disc and seat both machine ground to a perfect taper surface, giving perfect seat.

A combination proof against rusting, wedging, cutting, abrasion and leaking.

F. Full pipe size unobstructed passage through the disc. No obstruction to passage of steam as in ordinary disc valve.



Radiator or Straightway—with or without Union

Equip your Radiators with Gorton Valves and save money on the coal pile

GORTON & LIDGERWOOD CO., 100 Liberty St., New York, N. Y.

See Sweet's Architectural Catalog, page 1757, for Specifications—Write for Catalogs.

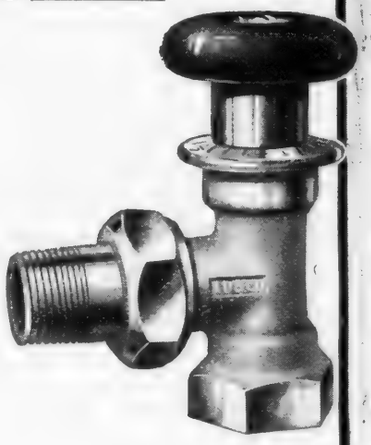
ADSCO HEATING

Greatest Economy—Greatest Comfort

STEAM from individual boiler in basement or from the mains of a Central Station is controlled *at the radiator.*

And the control is ***absolute,*** you can fill the top 1/5, 1/3, 1/2—*any* desired portion—of the radiator with steam, depending upon the heating effect required. No costly overheating. This perfect control saves 20 to 30% fuel cost.

Adsco Heating is the most simple, the most flexible, the most economical. It is absolutely silent. It is clean. Its simplicity—absence of air valves, return traps, vacuum pumps, etc.—saves you 15 to 20% on original and installation cost. The low pressures used mean constant operation and absence of leaks. It is easy to change over hot water systems to better controlled, more economical Adsco heating.



AMERICAN DISTRICT STEAM COMPANY

GENERAL OFFICES AND WORKS

NORTH TONAWANDA, N.Y.

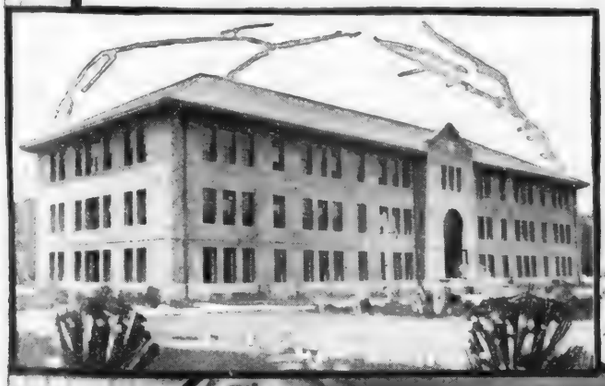
Agencies

First Nat'l Bank Bldg., Chicago — Barclay Sales & Engineering Co., 1777 Woolworth Building, New York — Hoge Bldg., Seattle

The HarPer Company, 2A Park St., Boston, Mass.

The Schley & Nash Co., 1404 Arrott Bldg., Pittsburgh, Pa.

Ask about Adsco Heating of building groups from Central Station steam plant. Bulletin 20-H: for individual buildings, Bulletin 150-H.



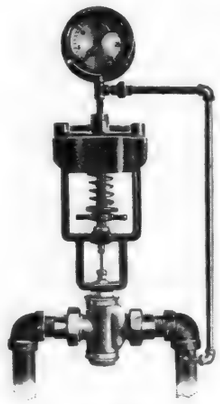
Tsing Hua College Buildings, Peking, China. Five buildings heated by "Adsco" System from a Central Station

Federal Realty Co. Building, Oakland, Calif. Adsco System.

Sylphon

Pressure Regulators
Reducing Valves

—have no rubber diaphragms to be *replaced!*



No. 952
Pressure Regulator

The reason is—the seamless, one piece bellows of drawn brass. There is not a bit of solder throughout its length—no chance for leaks or breaks. This is a feature found in no other Pressure Reducing Valve.

It will reduce and regulate pressures from any initial pressure to any pressure under 40 pounds and maintain it steadily without fluctuation. Its extreme sensitiveness makes it possible to reduce the pressure as low as 2 pounds. The instrument has spring adjustment, easily controlled by means of a ball bearing adjusting wheel. With this pressure regulator it is possible to take the controlling pressure from any desired point.

Write Department W now—for further information

The Fulton Company

KNOXVILLE, TENN., U. S. A.

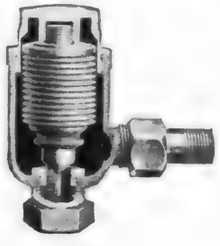
Representatives in all large centers

50 Church St. NEW YORK CITY
The Wrigley Building, 400 N. Michigan Ave. CHICAGO
1261 Book Bldg. DETROIT

Atlanta, Ga.
Baltimore, Md.
Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Charlotte, N. C.
Cincinnati, Ohio
Cleveland, Ohio
Dallas, Texas
Denver, Colorado
Des Moines, Iowa
Indianapolis, Ind.
Kansas City, Mo.
Los Angeles, Calif.
Louisville, Ky.
Memphis, Tenn.
Minneapolis, Minn.
Nashville, Tenn.
Omaha, Neb.
Philadelphia, Pa.
Pittsburg, Pa.
Rochester, N. Y.
Salt Lake City, Utah.
San Francisco, Calif.
San Antonio, Tex.
St. Louis, Mo.
Seattle, Wash.
Syracuse, N. Y.
Springfield, Ill.
Troy, N. Y.
Winnipeg, Canada

QUALITY SERVICE QUALITY

Heating Specialties that Last

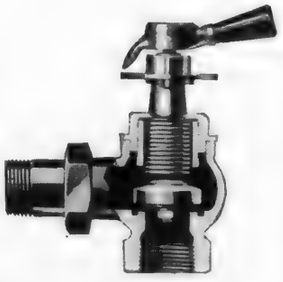


The B & B Line

In specifying the B. & B. Line of Heating Specialties for vacuum systems and Temperature Control Systems you are assured of getting QUALITY-SERVICE and a Heating Specialty that will last.

The B. & B. Multiflex Trap and B. & B. Multiflex Modulation Valve, as illustrated, are metal throughout and contain a B. & B. Multiflex Wonder Bellows. Note the simplicity in construction of the Multiflex Modulation Valve.

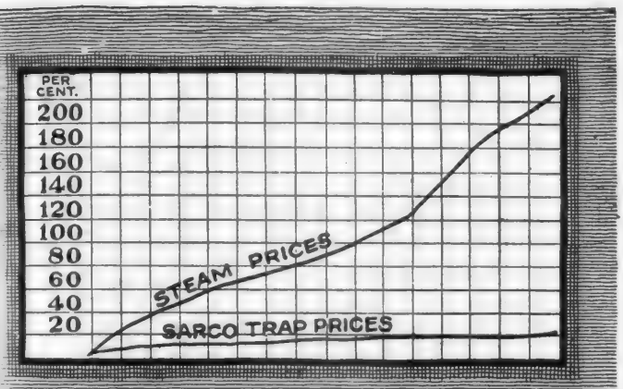
Literature sent upon request.



B. & B. Vacu-Vapor System
B. & B. Return Line System
B. & B. Air Line System
B. & B. Temperature Control System
B. & B. High Pressure Specialties

THE BISHOP & BABCOCK COMPANY

General Offices and Factories, CLEVELAND, OHIO



Stop Waste at the Coal Pile

Steam costs 200% more than it did five years ago, but Steam Trap SARCO prices have not increased more than 20%. The relation between cost and saving in dollars and cents is so much greater now than before the war that you cannot afford to leave lines untrapped or badly trapped.

Coal today is so high—and frequently so hard to get—that every shovelful counts. It will pay, and pay big, to check up on your steam line and see where coal is being wasted and money being lost through insufficient trapping.

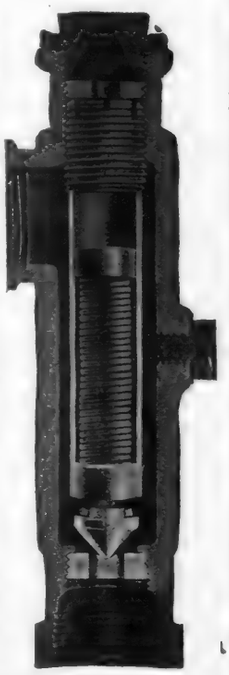
You can put in *three* Steam Trap Sarcos—*stop the loss at three different points*—for the cost of just *one* old-style trap.

The Sarco closes promptly and positively, prevents all loss of live steam. And it returns condensate to the hot well while still hot.

Sarco is so small and compact that it takes little more room than an ordinary elbow—can be installed at steam-wasting points where the bulkiness of old-style traps would make them out of the question. No platform, pit, or supports needed.

We are ready to let Sarco demonstrate its superiority and economy right in your own plant by sending you one on 30 days' trial without a cent in advance. If for any reason whatever you aren't satisfied with its performance, if it doesn't prove that it quickly pays for itself through the coal it saves, then you can return it and it won't cost you one cent.

Made in sizes ⅜" to 3", and for any given pressure up to 200 lbs.



Booklet No. P-12 and full particulars about our free trial offer on request.

SARCO CO., Inc.
231 Broadway, New York City

Buffalo Detroit Philadelphia
Chicago Cleveland

Steam trap SARCO

Dependable Warmth

Unless a heating system will provide a really dependable warmth, conveniently, economically and at all times, it is a source of trouble and actual loss to owner, contractor and architect.

Webster

SYSTEMS OF STEAM HEATING

assure a lasting protection from such difficulties. The Webster organization stands back of its product with a definite guarantee and is always ready to help the architect in planning an installation that will exactly meet every operating condition, the contractor in erecting it properly, and the owner in its operation.

This service, together with the mechanical excellence of Webster apparatus, has assured the success of each of the 17,000 Webster installations in buildings of every size and type throughout the country.

Send for Bulletins

145

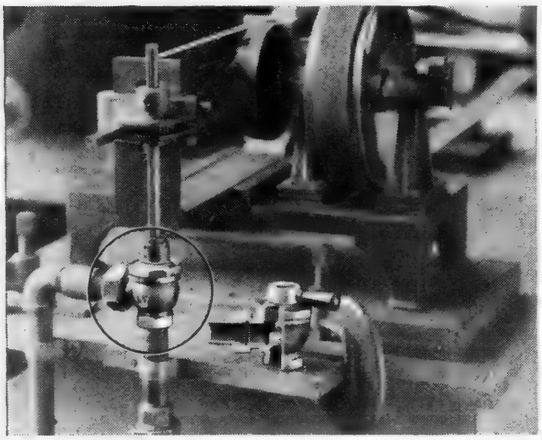
Warren Webster & Company

Camden, N. J.

31 Branch Offices

Residence of E. M. Statler, Buffalo, N. Y., equipped with Webster System of Steam Heating

The DUNHAM
REG. TRADE-MARK
HEATING SERVICE



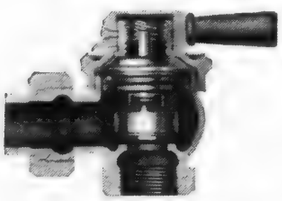
A million turns to test this Valve for quality

The Dunham habit of making sure a thing is right before passing it on, is strikingly shown in one of the tests of the Dunham Packless Radiator Valve.

A machine automatically opens and closes the valve just as it would be opened and closed in actual service. The valve is under working steam pressure. In opening and closing it seven-eighths of a turn, a certain amount of stress is put on the special metal diaphragms of the valve. We are entirely satisfied if the metal holds out for a minimum of one million turns—and believe you would be also.

The Dunham Radiator Valve is really packless. It is impossible for air to leak into vacuum systems through the Dunham Radiator Valve. The valve will not leak water or air on pressure systems. The feature of quick opening and closing is made possible in an extremely simple manner. In appearance, the valve is conspicuously neat, and admirably adapted for use in the most elaborate surroundings.

Full details of the Dunham Packless Valve and other Dunham Specialties, are given in the 15th edition of Sweet's Index, and in McRae's Blue Book.

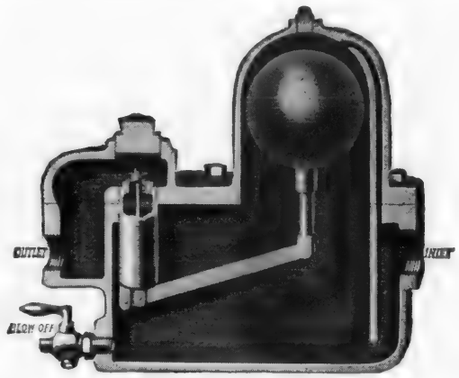


The body of the Dunham Packless Radiator Valve is constructed of red brass, the handle of cocobolo, and the diaphragms of a special composition disc are furnished with each valve. Made in angle pattern lever handled type.

C. A. DUNHAM CO., 230 East Ohio Street, CHICAGO

Factories: Toronto, Canada, Marshalltown, Iowa — 52 Branch and Local Sales Offices in the United States and Canada.

Branch Sales Offices in London and Paris



Wright "Victor" Steam Trap is especially designed for low pressure service and will discharge the full capacity of the inlet pipe, without any head or pressure. Absolutely no pressure is required to operate this trap and it will give perfect results under vacuum and any working pressure up to twenty pounds. It will operate perfectly against any pressure less than the initial pressure on the inlet of the trap.

Wright "Victor" Lowers Steam Trap Costs

Cut down your steam trap costs by using the Wright "Victor" Trap for low pressure service.

The "Victor" Trap is especially adapted for continuously draining large volumes of condensation from low pressure apparatus, such as heating systems.

The great capacity of the "Victor" is obtained by having a valve nearly as large in area as the inlet pipe—a different and very distinctive feature of the "Victor" Trap.

Because the "Victor" has so much greater capacity than other traps, smaller sizes or, by grouping the drains, a smaller number of "Victor" Traps may be used with decided economy in first cost as well as in maintenance.

Extreme simplicity, great capacity and low cost are dominant features of the "Victor" Trap.

Write us about your trouble from condensation, improper heating, etc. Let our engineering department help you solve these problems.

W-A Standard with STEAM USERS SINCE '94

WRIGHT-AUSTIN COMPANY

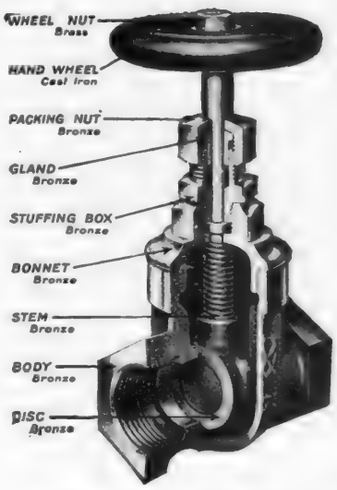
Detroit, Michigan

Branches: New York Boston Chicago

Representatives Everywhere

(24)

What is Your Valve Standard?



Most any valve will work well when new, but it takes a high grade product to stand up for a long period of years and to continue to give one hundred per cent efficient service. That's why engineers and contractors should safeguard the future interests of clients and customers by specifying the KENNEDY. In this way their specification carries with it the protection which the KENNEDY name and KENNEDY guarantee insure to valve users.

KENNEDY

For 42 years valve satisfaction has been the one object of the KENNEDY organization, and the improvements and developments which mark all valves bearing their trademark are sufficient proof of the success of their efforts. Special features embodied in the design for the distinct purpose of giving long life include:

Pipe threads of generous length which prevent leakage.

Accurate guides for seat which prevent contact of disc with seat until the valve is ready to close.

Stem of special bronze with high tensile and torsional strength.

Gland in stuffing box which eliminates leaks and avoids frequent repacking.

Other special features of Kennedy Valves are given in our latest catalog. Send for copy and keep it handy. 249

THE KENNEDY VALVE MFG. CO.

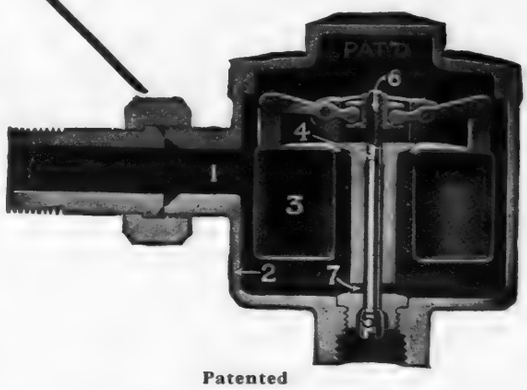
Branch Offices and Warehouses
NEW YORK: 95 John St.
SAN FRANCISCO: 23-25 Minna St.
BOSTON: 47 India St.
CHICAGO: 204-8 N. Jefferson St.
EXPORT OFFICE: 95 John St., New York City

MEMBERS THE NATIONAL TRADE EXTENSION BUREAU OF THE PLUMBING AND HEATING INDUSTRY. PERMIT No. 78 REGISTERED

SALES OFFICES:
Philadelphia, Continental Hotel Bldg.
Salt Lake City, 503 Dooley Bldg.
El Paso, 704 Two Republics Bldg.
Winnipeg, Can., Chamber of Commerce Bldg.

A Steam Trap that Automatically Eliminates Air and Water Condensation Without Allowing Escape of Steam

THE McDonald Under-Seat Valve is the only valve of its kind on the market. The principle of operation is positive and noiseless. It gives perfect service on any radiator on a two-pipe heating system and under any ordinary pressure up to ten pounds. Handles and discharges a much larger quantity of water than any other trap or valve of equal size. Self-cleaning. Carries away all scale. Entire inside instantly removable by loosening cap. Saves every ounce of steam. Its economical features are greatly appreciated by the building owner.



Patented

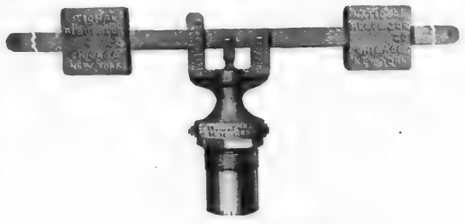
Leading architects, heating engineers and contractors are specifying and installing large numbers of the McDonald Under-Seat Valve, because its superior features have been proven in service.

Write for detailed information

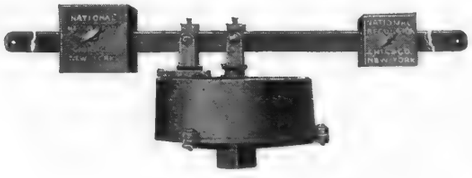
The McDonald Under Seat Valve Co.

602 Swetland Building **CLEVELAND, OHIO**

HOT WATER LOW PRESSURE



2″ for Hot Water



7″ for Low Pressure and Vapor

Made in 2″, 4″, 7″ and 10″ sizes

Metaphram Damper Regulators

For Low Pressure and Hot Water Boilers

also

Metaphram Regulators

For Hot water Tanks, Ovens, Pots, Driers, Refrigeration and other industrial processes.

Send for Circulars

TRADE METAPHRAM MARK REG U.S PAT OFFICE

NATIONAL REGULATOR CO.
FACTORY AND GENERAL OFFICES
208-212 South Jefferson Street
CHICAGO

VAPOR

A-JACKS for HIGH PRESSURE

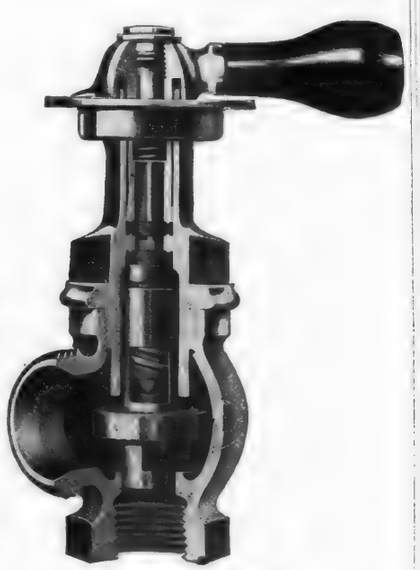
LAVIGNE

PACKLESS QUICK-OPENING STEAM RADIATOR VALVES

HAVE BEEN APPROVED BY THE HEATING TRADE because they have made good in decided fashion during the many years they have been on the market. Heating engineers who specify them regularly on their good jobs do so from the conviction born of knowledge of their performance, that these valves are equal to any demand made on them.

Lavigne Features

Leakless, Packless, Quick Opening, Standard Height, Well Made and Finished, Simple and Rugged, Shapely and Balanced, Inexpensive on a Basis of Results.

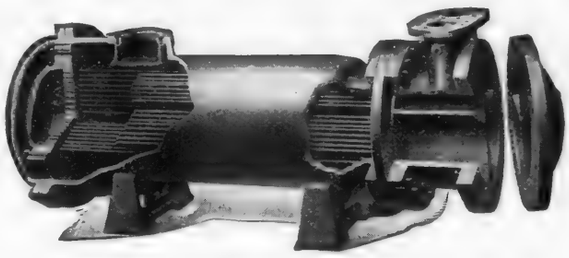


Sectional View
Lavigne
Graduated Packless Valve

BUILT RIGHT—TO STAY TIGHT
Made in six sizes, many styles of handles
All good jobbers handle them

COMMONWEALTH BRASS CORPORATION DETROIT, MICH.

Stop Heating the Atmosphere!



Use the exhaust steam which is going up the stack to heat water for boiler feed or any other purpose.

G-R Instantaneous Heater

Utilizes either live or exhaust steam as the heating medium. The multipass heating surface insures rapid heat transmission.

HOT WATER ALWAYS AVAILABLE

Send for Bulletin No, 231

THE GRISCOM-RUSSELL CO.

2155 West Street Building, New York

Philadelphia
Boston
Hartford
Springfield

Pittsburgh
Cleveland
Toledo
Detroit

Chicago
Minneapolis
Milwaukee
St. Louis
Denver

New Orleans
Houston
Fort Worth
Charlotte

San Francisco
Seattle
Los Angeles
Kansas City

SERVICE

Air Conditioning

THE REAL TEST

in air conditioning, as in other lines of engineering work, lies in the new problems that arise. Our well equipped research laboratory, where for years we have been solving problems not covered by formula, is now at the service of consulting engineers.

Full information and catalogue, covering all phases of air conditioning work, can be obtained by requesting a personal call or by correspondence.

W. L. FLEISHER & CO. Inc.

"THE CLIMATE DOCTORS"

31 UNION SQUARE WEST NEW YORK CITY

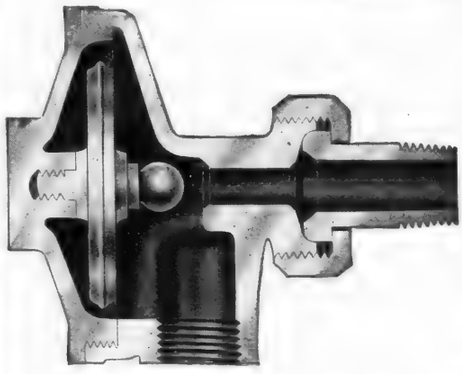
HUMIDIFYING FOR SILK MILL

Sturtevant APPARATUS

ILLINOIS · HEATING · SYSTEMS

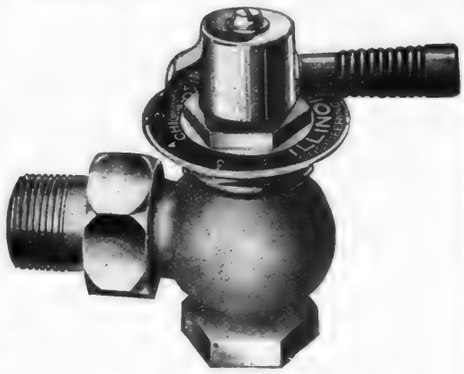
VACUUM **VAPOR**

Have been successfully installed in thousands of buildings—
A RECORD OF 20 YEARS OF SUCCESS



SPECIFY
THESE
ILLINOIS VALVES
whenever you want the best

Write for New Vapor Catalog—real data



THERMO RADIATOR TRAP

The Original Vertical Seat Trap.
Dirt proof. Closes against the steam.
Positive operation and long life.

ILLINOIS MODULATING VALVE

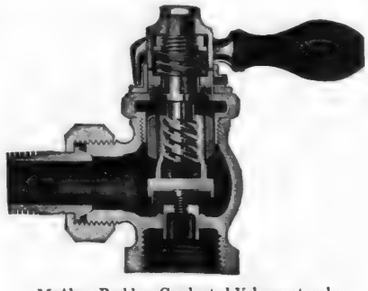
A half turn from full open to closed.
All working parts accurately machined.
Easiest operating valve on market.

"Illinois Heating Systems make warm friends"

ILLINOIS · ENGINEERING · COMPANY

Racine Ave. and 20th Place, CHICAGO

Representatives in 21 principal cities **Consult local telephone directory**



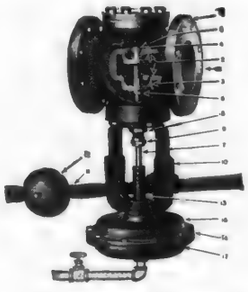
McAlear Packless Graduated Valve, not only the handsomest graduating valve but the simplest and of the best construction of any valve on the market.

The Experience of Over a Quarter of a Century is Behind

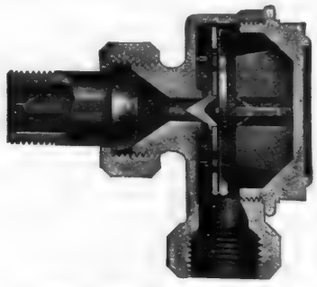
·McALEAR·

Vacuum, Vapor, Low and High Pressure

Heating Specialties



Acme Vacuum—Vapor Pressure Regulating Valve
Full Area—Accessible



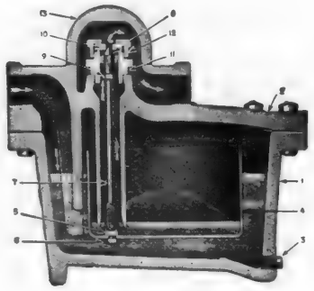
McAlear Perfection Radiator Trap will close tight against a steam pressure of 15 lbs. when discharging direct to the atmosphere, or into a vacuum of from 1 to 25 in.

Recognized the world over as STANDARD

We manufacture and carry in stock a complete line of Steam, Water and Air Specialties for Steam Heating and Power Plants.

Our catalogue No. 25 is ready for you

Our new bulletins A, B, C, D, E—covering McAlear Heating Specialties—are yours for the asking.



Universal Steam Trap
Reversible Seat—Accessible

THE McALEAR MFG. CO., 1901-7 So. Western Ave., Chicago

Telephone Canal 7201-7202

The Heating and Ventilating Magazine

VOL. XVIII. NO. 9

CONTENTS FOR SEPTEMBER, 1921

Landmarks in the Development of House-Heating Boilers.....*E. C. Molby* 27
A Review of the Progress Made and an Outlook on the Future of the Industry.

Savings Effected in Heating a Cleveland Office Building.....*L. J. Pauley* 29
Remarkable Record Made in the Operation of the Guardian Building During the Winters of 1919-1920 and 1920-1921.

A Program for Smoke Prevention and Fuel Conservation.....*E. Vernon Hill* 33
Details of a Proposed Block Plan of Heating, Together with Municipal Ownership and Operation of Gas Plants.

Fuel Economy in Heating Service.....*A. Bement* 36
Comments on Present Practice in Down-Draft Boiler Design with Suggestions for Improvements.

Some Practical Experiences with Ozone..... 38
Observations of Its Effect in Ventilating Work, Both as a Health Tonic and Fuel Saver.

Economy and Waste in Warming Buildings.....*S. Homer Woodbridge* 40

Instruction Course for Custodians and Janitors.....*Edwin S. Hallett* 42
Lesson No. 8—Hot Water Supply.

Fuel Situation in New York City.....*Joseph M. Lonergan* 43

Wrinkles 45
Piping Connections for Air Venting and Uniform Circulation in Water Heating Systems.
Increasing the Circulation in Gravity Water Heating Systems by Replacing Elbows with Offsets.
How to Prevent Hot Water from Short-Circuiting in Pipe Coils.
Some Common Faults of Chimney Construction Remedied by Simple Stack Extension.
Lift Fittings Make It Possible to Install Radiators and Piping Below the Returns of Vacuum Systems.
Preventing Freezing Troubles in Intermittently Heated Buildings.

Chats with Uncle Ben..... 48
Automatic Temperature Regulation.

Correspondence 50
Figuring Fixed Charges or Operating Costs.

American Society of Heating and Ventilating Engineers..... 51
The New Director of the Heating Engineers' Research Laboratory.

The Trend from Down-Draft to Up-Draft in Smokeless Boiler Design..... 52

Types of Water Service Heaters..... 54

Humidifying Devices for the Home..... 56
No. 9—Wright-Marshall Air Moistener.
No. 10—Bridge-Beach Humidifier.
No. 11—Buck's Humidifier.
No. 12—Savo Air Moistener.

Standard Heating and Ventilating Data Sheets..... 64
No. 1-ZZZ—B. T. U. Losses—Jones' Tables (concluded
No. 13-D—Radiation Computing—Transmission from Direct Radiators
No. 132-X—Vapor Heating—Hutchison System
No. 132-Y—Vapor Heating—Hutchison System (concluded)

Advertisers' Index, Page 98.
Engineers' Specification Index, Page 92.

YEARLY SUBSCRIPTION $2.00 **SINGLE COPIES, 20 CENTS**

Published monthly at Cooperstown, N. Y., by the Heating and Ventilating Magazine Co.
Executive and Editorial Offices 1123 Broadway, New York

Entered as second-class matter at the Post-Office in Cooperstown, N. Y.
Copyright, 1921, by The Heating and Ventilating Magazine Co.

ALLEN AIR-TURBINE VENTILATOR

Standard of Ventilating Efficiency

Wherever ventilation is desired—in factories, foundries, stores, schools, hotels, churches, theatres, residences, kitchens, bakeries, tanneries, barns, stables, garages, chimneys, air shafts, or wherever air circulation is required, Allen Air-Turbines *have proven the best, cheapest and most efficient* ventilating system known.

Many of America's largest architects, engineers and industrial concerns have adopted and endorse Allen Air-Turbine Ventilators.

Patented

Our air displacement is measurable and the figures given are guaranteed to be correct.

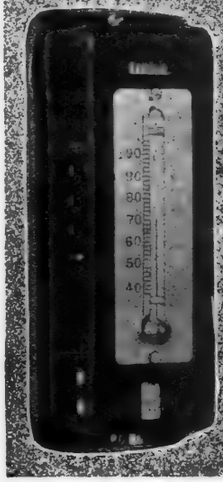
Diameter of Pipe	Air Displacement Cu. Ft. per Hour	
	Wind Velocity 4 Miles per Hour	Wind Velocity 8 Miles per Hour
8 Inches	17,300	21,600
10 "	26,500	32,500
12 "	38,600	46,200
15 "	54,000	69,000
18 "	85,200	102,100
20 "	105,100	125,600
24 "	149,000	185,000
30 "	225,000	272,000
48 "	360,000	473,000

CARRIES OFF
GASES
MOISTURE
STEAM
SMOKE
VAPOR
FOUL AIR
ODORS
HEAT
FUMES
DUST
DAMPNESS

Write for Detailed Literature

ALLEN AIR-TURBINE VENTILATOR CO.
DETROIT Eighth and Porter Sts. MICHIGAN

JOHNSON SYSTEM
SUPERIOR HEAT - CONTROL



The All-Metal Apparatus

No Rubber Diaphragms in either Thermostats or Valves

The Only System Constructed of Nothing but Metal

JOHNSON SERVICE COMPANY
MILWAUKEE - U.S.A.

The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

SEPTEMBER, 1921

LANDMARKS IN THE DEVELOPMENT OF HOUSE-HEATING BOILERS

A Review of the Progress Made and An Outlook on the Future of the Industry

BY E. C. MOLBY.

IN the early days of heating boilers, each manufacturer made the very best boiler he or his engineer could design, with the result that each boiler showed originality and each manufacturer endeavored to excel every other manufacturer in boiler construction and efficiency. During this period there was little price competition. Each manufacturer sold his boiler on its merits and the boiler salesmen showed real boiler salesmanship in obtaining the manufacturers' price, based on the quality of his boiler.

Among these earlier types of boilers were the Florida, a magazine-feed, jacketed boiler, with large heating surfaces and and a long fire travel. The Florida was an efficient boiler and had a great many friends. The Spence water heater claimed a unique water circulation. It was a round horizontal sectional boiler with a back water post, the water traveling from one side of the post around the various sections into the other side of the post which was open to the piping system. The Humber and Ideal, as also the Gurney and Novelty Circulator, were water heaters constructed with special water circulation and sold on catalogue claims of superiority. The Perfect water heater and the Sunray heater were also brought out at this time and were similar in heating surface construction, as well as in water circulation.

Among the steam heaters was the Soleil, with a special circulating water way for equalization which was thought necessary at that time. Then there was a long line of header boilers, among them the Royal, the Mercer, the Mills, the O. K. and the American. The Faultless Furman was made with double circulating drop tubes over the fire. This was a cast-iron boiler with loops screwed into the dome. About this time the Bolton boiler was also brought out. This was a steel boiler, with a double circulating tube. The Haxton, Dunning and Mahoney were other steel boilers of special designs.

These were only a few of the boilers manufactured in what are known as the early days of heating boilers. There were many more, each containing special features of construction, both as to water circulation and fire travel. None of these heaters, it should be noted, attempted or claimed special combustion advantages. At that time there was very little said about length in firing periods. Any of these boilers would carry fire for an eight-hour period.

In this competition of merit prices varied. Each manufacturer made such prices as he thought the finer construction and operation of his boiler entitled him to receive, and the construction of the boiler received thorough consideration by the salesman and his customer. These were all mechanical or construction differences and related to fire and water circulation.

The ratings of these boilers were very conservative and in nearly every instance were net ratings. The boilers were guaranteed to carry their rating in radiation, besides the necessary mains and risers. The prices of boilers, however, gradually lowered and competition became more or less a price competition.

ERA OF THE CARBON CLUB.

About this time the Carbon Club was organized and most boiler manufacturers became members of the Carbon Club. The Carbon Club, as is well known, was a price organization. The prices were based on the rated capacities of boilers and each member agreed to sell his boiler at these prices. During the days of the Carbon Club, the competition was strictly on a quality basis. Each manufacturer was forced to make the very best boiler possible for, even with an even price, the manufacturer who had the best boiler usually secured the order. The purchaser of heating plants at that time secured full value for his money because the manufacturer was endeavoring to see how good boiler he could make and was adding value to his product. The house owner measured the boiler quality only, as the prices were equal.

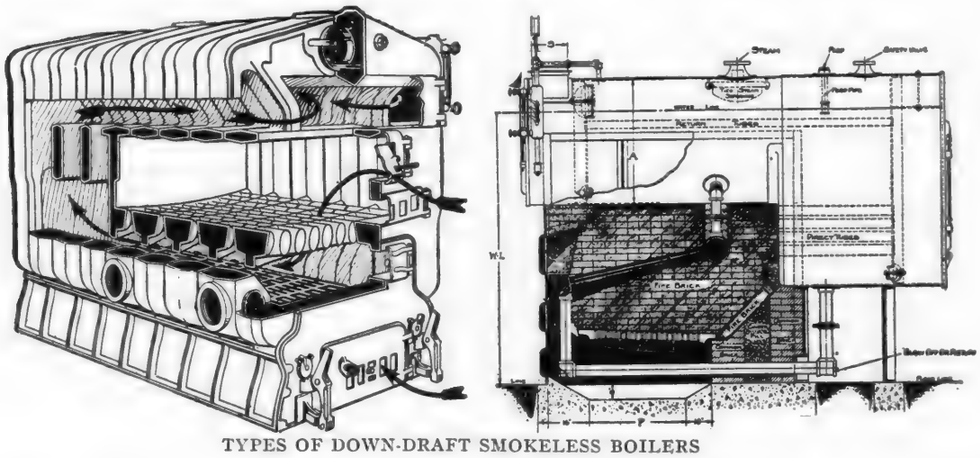
PRICE COMPETITION VERSUS QUALITY COMPETITION.

When the government enacted laws dealing with price organizations, the Carbon Club went out of business. Then began an era of price competition, instead of quality competition. The ratings of boilers were raised sometimes 100%. Heating surfaces and value were taken out of the boilers in order to have the lowest price for a given rated boiler. This competition, it may be added, has continued up to the present time.

Under this new condition the construction of boilers was changed. Everything that could be taken away and still leave a boiler was taken. Not only were the ratings raised, but grate measurements in the catalogues expanded. The manufacturers were obliged to make lower-cost cast-iron boilers. The house owners, who were the ultimate purchasers of these boilers, suffered as they were the ones who were obliged to pay the expense of the heating plants. This refers to the competition type of boiler of which so many thousands have been used in speculation work by realty operators, and speculative builders who built apartment buildings and houses for sale.

ALWAYS A MARKET FOR BETTER-QUALITY BOILERS.

All boilers, however, were not changed, and there has always been a market for the better-quality boilers. The large number of competition boilers that have been used, however, has been a source of liberal education in boiler efficiency and has forced the production of better boilers. The various manufacturers have recognized this demand by bringing out specially-designed boilers with the object of lower fuel costs and higher efficiency. During the period of price competition individuality in boilers lessened and each manufacturer made boilers of the same type. When new boilers appeared that were lower in cost of construction, they were frequently copied, instead of leading to new designs, so that price competition, as was shown in this development, may easily be an enemy of good construction.



TYPES OF DOWN-DRAFT SMOKELESS BOILERS

ADVENT OF THE "SMOKELESS" BOILER

Such was the state of the industry when the so-called, "smokeless" boiler appeared, being the direct result of the demand for the improvement along combustion lines. The Hawley down-draft principle was adopted by many manufacturers as the highest quality of boiler construction. This type of boiler was smokeless, with limited smoke periods, and soon justified its existence in its ability to burn bituminous coal with good economy.

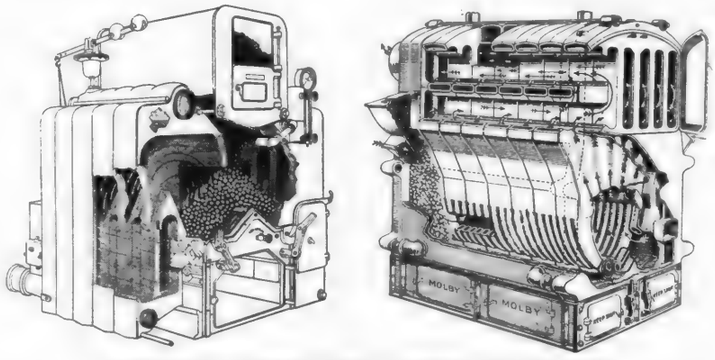
The magazine-feed smokeless boiler also made its appearance and proved the great value of the magazine-feed principle in burning the smaller cheaper grades of coal. The magazine is now the most important feature of a number of smokeless boilers. Due to the fact that the coal in the magazine gradually passes into the heat zone, the temperature of the combustion chamber is never lowered on account of draft taken directly to it, or by adding low-temperature fuel at that point. This has resulted in the advantages of a steady rate of combustion, the same draft resistance continuously and even combustion temperatures.

Another feature of the magazine-feed smokeless boiler is the arrangement by which ashes accumulating on the grate do not stop draft or combustion throughout one firing period, as the draft is not taken through the grate where the ashes accumulate, giving to this type of boiler a steady rate of combustion and an almost equal hourly consumption of fuel during a firing period.

While at first there were only a few types of up-draft smokeless boilers to be found on the market, their number has notably increased. In these boilers the fresh coal is usually added to the front of the fire and pushed back after the volatile matter is consumed, or, as it is usually expressed, after the coal has become coked. Oxygen is admitted in various ways through air slots to the entrance of the combustion chamber for the full consumption of the gases.

IMPORTANCE OF GOOD CHIMNEY CONSTRUCTION

The writer has always thought that there has never been enough attention paid to chimney construction and it is particularly gratifying to know that the City of New York is in line for an ordinance which will require builders to provide proper chimney flues for all plants. The National Board of Fire Underwriters, as is well known, has taken up the matter of chimneys and has prepared specifications for building construction with special regard to the different types of chimney installations, embodying them in a model code suitable for adoption by the various cities throughout the country. The adoption of this ordinance by the larger cities will mean a great improvement in the operation of all heating boilers and will bring to the house owner full returns for the additional expense, through the improvement in the economy and efficiency of his heating plant.



TYPES OF MAGAZINE FEED SMOKELESS BOILERS

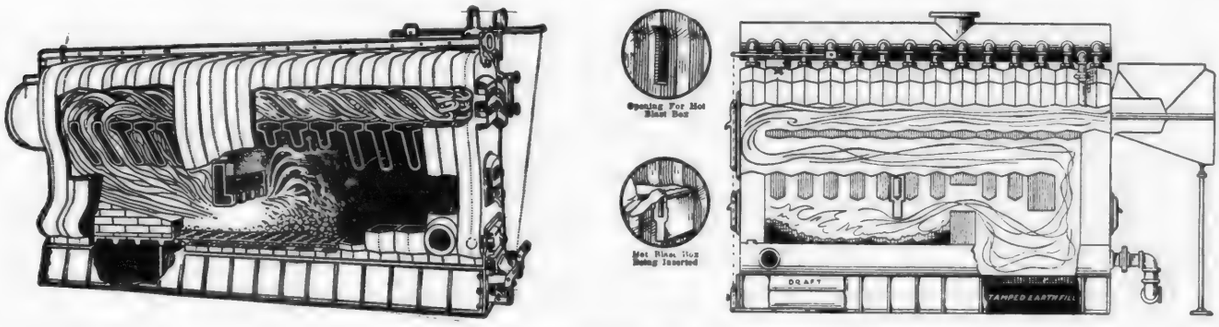
The chimney construction requirements should be given the first consideration in the building of a house. The kind of chimney that is available for the heating plant in the old house should be carefully considered before installing any type of smokeless boiler. The smokeless boiler does not require a better chimney than any boiler should have, but all chimneys should be good and it would be a matter of economy for the house owner to build a new chimney, if necessary, as the savings in fuel would more than offset this cost.

All boiler chimneys should be tight, the chimney for the

smokeless boiler especially so. Otherwise the boiler will be slow in operation and a low fire will take a long time to come up, as the chimney will be drawing air through the leakage points, instead of through the fire. The resistance to draft in down-draft boilers, with their heavier bodies of coal, is greater than in the up-draft boiler where there is a thinner layer of fire and a larger-size flue.

IMPROVEMENTS ALSO SEEN IN HEATING SYSTEMS.

Not only have boilers been improved in recent years, but the heating systems have kept abreast of boiler development. At the present time it is possible to install a heating apparatus which will show the highest efficiency ever obtained and bring the operating cost of the heating plant very low.



TYPES OF UP-DRAFT SMOKELESS BOILERS.

The time has come when the buyer of boilers is discriminating in favor of quality and is not depending entirely on price. So that price competition on good constructions is not a fact. The operator who is building large numbers of houses will still continue to install over-rated, low-efficiency and high-operating-cost boilers because he can buy them at a low price, but in the better-class houses the higher type of boiler will be used and the buying public will reap the benefit of these economies. The time will also come when smokeless boilers will be purchased at a lower cost than at present. The operator will be able to give to his clients the type of boiler which will show a great saving in fuel and help the purchaser to pay for his home, instead of keeping up operating costs to such a level that he becomes a slave to the home he is trying to buy, or loses it entirely. The proper adjustments of labor and freight will do much to help the building situation and release the final purchaser from a large amount of the present expense in the purchase of a home.

A LOOK INTO THE FUTURE.

We have passed through a period of business depression and high prices during which the purchaser has refused to go ahead with building construction. At the present time there is a tremendous shortage of buildings of all types. This shortage will be met within the next few years and the demand will be for a better type of house and a better type of heating plant. This demand will lead to a larger heating construction wherein will be used low-pressure cast-iron boilers, instead of power boilers, because the efficiency of the cast-iron boiler is being developed beyond that of the power boiler, and in this day of electric power with individual motors, the factories and manufacturing plants will find it to their advantage to use these highly-developed and efficient boilers for their heating needs.

In this coming large business there will be a still higher development of the low-pressure boiler. Until recent years, boiler development was along the lines of fire travel and heating surface construction. The higher development of cast-iron boilers will be along the line of combustion. Arrangement of heating surfaces will be secondary. Manufacturers will develop the art of burning coal obtaining the highest value in the fuel burned through creating proper conditions for combustion.

New ideas in boiler building are constantly appearing and it is possible that in the future, better adaptation of combustion principles will create a new era of boiler advancement. The smokeless principle of burning has been brought to a high standard, but there may still be room for a higher point of efficiency.

It is up to the boiler manufacturers to put forth every effort to develop the boiler industry to the highest standard possible. The boiler manufacturers of the country are capable and well worthy of the confidence of the boiler buyers. The future of cast-iron boilers can be left in their hands with confidence that the highest types will be brought out which will insure to the user the benefits of all that is possible in the way of convenience and economy.

SAVINGS EFFECTED IN HEATING A CLEVELAND OFFICE BUILDING

Remarkable Record Made in the Operation of the Guardian Building During the Winters of 1919-1920 and 1920-1921

BY L. J. PAULEY,
Manager of the Guardian Building.

(Presented at Annual Convention of National District Heating Association, Cedar Point, O., June 22-24, 1921.)

THE Guardian building is fifteen stories in height, class A construction, erected on land fronting 132 ft. on the north side of Euclid Avenue, extending through to Vincent Avenue a distance of 250 ft., thus having a front and entrance on both streets. There is a ten-story building on its westerly side, and the buildings on its easterly side will average

five stories in height. The building has 83,431 sq. ft. of radiation and 4,415,104 cu. ft.

The Guardian Bank occupies the larger portion of the ground floor and basement, all of the second floor and half of the third floor. The main banking room is large and spacious, with a very high ceiling, and is ventilated and heated by washed air.

The building is equipped with a single pipe dry vacuum heating system, known as the Paul system.

One year ago the large increase in cost of steam brought about by the enormous increased cost of coal was the prime cause for an engineer's survey of our heating plant. The result of the survey was that our single pipe system was inefficient, wasteful and not the type of system for so large a building, notwithstanding the fact that perfectly reliable engineers and architects had installed it only four years previous. It was recommended that the system be changed to a two-pipe system at a probable cost of $35,000.00.

INSUFFICIENT TIME PREVENTED.

Insufficient time to make the change before the heating season began, together with the cost of it, was the cause for delaying the change, so we decided we would use the present system another year and advise more efficient methods of operation.

The results gained during the past winter as shown by the charts are such as to delay, if at all, any radical change in our system and leads me to conclude that the manner of operating a heating system is fully as important as the system itself.

Our record shows that seven months of operation during the heating season resulted in 34,059,500 lbs. less steam used, with a saving in cost at this year's prices of $28,904.08, and if figured at last year's prices it would be $12,620.82. Of this approximately 25% is due to more favorable weather conditions and I have been very liberal in this calculation.

SAVINGS AS SHOWN BY CURVES.

Chart No. 1 shows graphically the results of the saving campaign carried on in the Guardian building. The heavy black curves in black show the average monthly temperatures; the hatched curves the daily consumption of steam for heating; the next black curves the daily steam consumption for hot water, and the lower green curves the daily consumption of steam for heating divided by the difference in temperature between 65 degrees and the average outside temperature.

Little need be said about the steam used for heating water. We have a small economizer for pre-heating the water by using the heat in the condensed steam from the heating system, and we keep the temperature of the water as low as we can consistent with good service.

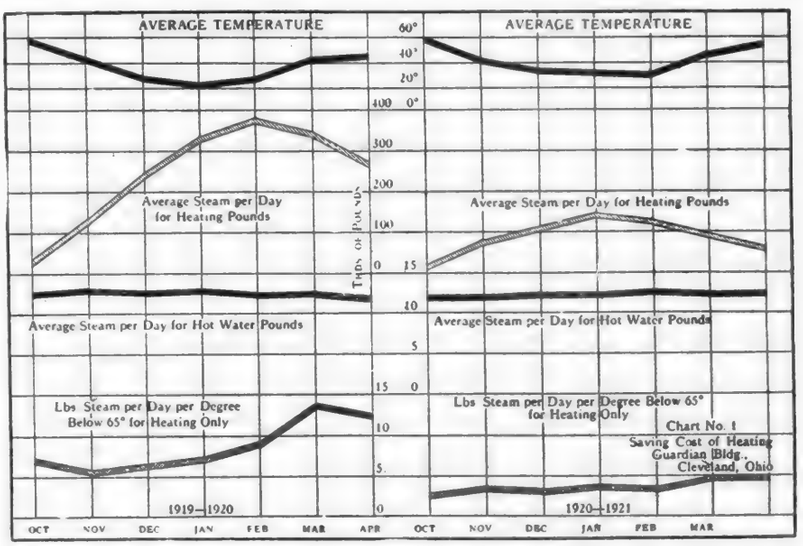

AVERAGE TEMPERATURE
AVERAGE TEMPERATURE
60°
40°
20°
0°
Average Steam per Day for Heating Pounds
Average Steam per Day for Heating Pounds
Average Steam per Day for Hot Water Pounds
Average Steam per Day for Hot Water Pounds
Lbs Steam per Day per Degree Below 65° for Heating Only
Lbs Steam per Day per Degree Below 65° for Heating Only
Chart No. 1
Saving Cost of Heating Guardian Bldg., Cleveland, Ohio
1919—1920
1920—1921
OCT NOV DEC JAN FEB MAR APR OCT NOV DEC JAN FEB MAR

CHART NO. 1—SAVING IN COST OF HEATING GUARDIAN BUILDING, CLEVELAND, OHIO.

The lower double-hatched curves merit careful attention, however, as they tell the whole story. Although normally we keep the building at 70°, these curves have been calculated for temperature of 65°, as it has been found that when the outside temperature is 65°, no steam is required for heating.

For the first four months of 1919 the operation was fairly normal, with only such wastage as might be expected in a building where no particular attention was given to the heating question. From January, 1920, on, however, there was an abnormal and serious waste, due primarily to the custom of giving a tenant all the heat he wants. Also, I think this wastage in February, March and April reflects the general carelessness and demoralization of the American people during that period.

The rise in the curve for February, March and April shows the seriousness of this loss. March, particularly, was a poor month, being warm the first part and cold the latter part. It appears as if our tenants felt that they needed steam because, being the first part of March, it was too early to turn off the steam, and not because they were cold.

Going to the same curve for the past season, it will be noted it is much more uniform, although again there is a rise during March and April. While this reflects some loss, it is nowhere near as serious as the previous year. This loss, we believe, is due to the impossibility of heating economically during a time of the year when the temperature is varying within wide limits.

COMPARATIVE SAVINGS WITH DIFFERENT TYPES OF HEATING SYSTEMS

Chart No. 2 is submitted to show a comparison between different types of heating systems.

Building A is the Guardian building, with a single-pipe system, dry vacuum air line.

Building B is another office building of the same general construction, but with a two-pipe system. This building is, perhaps, slightly more exposed than building A.

Building C is also an office building, with a single pipe system similar to building A, but with automatic thermostats in the rooms.

From this it will be noted that during the season of 1920-1921 building A used 46% of the steam used during the previous season after correcting for the difference in outside temperature. Building B used 4% more steam, and building C used 93% of the steam used during the previous season.

Further, during the season 1920-1921, building A used 78.5% of the steam used by building C with thermostatic control. This shows that even thermostats are not human, and if tenants open the windows, thermostats will turn on the heat, and loss is bound to occur.

Chart No. 3 shows this same comparison more in detail. The top curves show the steam consumption per day per square feet of equivalent radiation per degree below 65°, and the bottom curves the pounds of steam per day per 100 cu. ft. contents of the building per degree below 65°.

The black curve is for building A. The hatched curve is for building B. The double-hatched curve is for building C.

Note the more constant results for building C than the other two buildings; also the rise in all the curves during March and April for both years. This latter point reflects the loss occasioned by fluctuations in the outside temperature.

Further, note the relative position of the black lines with respect to the other two curves for the two seasons. This shows

CHART NO. 2—COMPARATIVE STEAM CONSUMPTIONS OF OFFICE BUILDINGS

BUILDING A—SINGLE PIPE SYSTEM VACUUM AIR LINE.
BUILDING B—TWO PIPE SYSTEM VACUUM.
BUILDING C—SAME AS BUILDING A WITH THERMOSTATIC CONTROL.

	Building A		Building B		Building C	
Cu. Ft. Contents	4,415,104		3,794,430		2,337,758	
Sq. Ft. Direct Radiation	40,003		48,924		29,125	
Sq. Ft. Indirect Radiation	7,236		2,670		2,484	
Sq. Ft. Equivalent Radiation	83,431		64,944		44,021	
Sq. Ft. Equiv. Rad. Per Cu. Ft. Contents	.0188		.0179		.0192	
Season	'19–'20	'20–'21	'19–'20	'20–'21	'19–'20	'20–'21
Ave. Temperature	36°	43°	36°	43°	36°	43°
Lbs. Steam Per Season Heating Only	52094000	18216300	35032745	27742095	17318465	12272200
Lbs. Steam Per Season Per Sq. Ft. Rad.	625	219	539	427	393	279
Lbs. Steam Per Season Per Cu. Ft. Contents	11.8	4.1	9.2	7.3	7.4	5.2
Lbs. Steam Per Sq. Ft. of Radiation Per Day Per Degree Below 65°	.100	.046	.086	.090	.063	.059
Lbs. Steam Per 100 Cu. Ft. Contents Per Day Per Degree Below 65°	.189	.087	148	.154	.119	.111

the importance of the human equation in the economical operation of heating systems.

MEASURES TAKEN TO EFFECT SAVINGS.

Now what was done to effect this saving?

First. In starting out we desired our heating apparatus to be in perfect working order, for we had determined to get the best possible results from it in a thorough test before spending a large sum of money to revamp it as had been suggested.

The vacustats were all removed from the radiators and sent to the factory that made them for a complete overhauling. The supply valves at the radiators were all removed, cleaned and adjusted in our own shop, paying particular attention to the seats to prevent leakage when shut off. All traps were carefully gone over.

The steam meter readings were taken daily and tabulated together with outside and inside temperatures. By daily comparison of steam consumption any wasteful defect in the functioning of the system could be detected and corrected without delay and loss.

All windows were calked and weather-stripped to get a minimum of leakage. The building was gone over from top to bottom and everything was done that would help to keep cold air out and retain the warm air. Elevator shafts, stairs and leakages that cannot be remedied are in most buildings quite sufficient to give adequate ventilation and in many cases much more than is needed.

Each day at 6 p. m. each of the 1,200 windows were inspected to see that they were properly closed.

A carefully-prepared letter was sent out to each tenant asking their co-operation in the economical use of heat by the proper use of valves and not needlessly opening windows with the radiators as hot as they could get them.

Twenty-five thermometers were placed in various parts of the building so the temperature of the building, as a whole, could be determined at will.

The steam supply shut off from the entire plant at 5 p. m. in ordinary weather, earlier in mild weather and later on colder days.

Reading of the thermometers were taken at 6 p. m. and 10 p. m. to know how long under various outside temperatures it took the building to cool off to 50° or 60°, never permitting it to go below 50°, which would occur only on very cold days.

Readings were again taken at 3 a. m. so the engineer on duty would know at what time, under various outside temperatures, steam must be turned on to get the temperature of the rooms up to 68° or 70° by 8 a. m.

STEAM SHUT OFF AT NIGHT.

At no time during the past winter did we fail to shut off the steam entirely at night, and only two or three times did we find it necessary to turn steam on a few hours on Sunday to prevent the building from cooling off below 50°.

Readings were again taken at 7:30 a. m. that we might know that the temperature of the office would be up to 68° by the time the tenants came in, great care being exercised not to heat above 70°, for in that case windows would be opened, which we were determined to prevent. I worked on the theory that it was wise to create a condition whereby the tenants were obliged to lend their aid in order to have comfortable rooms. If they persisted in opening windows, their rooms would be uncomfortable, because it was our purpose to only turn sufficient steam into the system to properly heat the rooms with windows closed. I think every complaint, and there were few, was due to improper use of windows or leakages that were promptly remedied.

In taking the temperatures of the various rooms, I ran across some interesting developments. One room would be up to 70° and the one next to it, in some cases, would be 60° or lower. In such cases investigation developed the fact that either the steam was shut off at the radiator, or a window was open that had been missed during inspection, or possibly opened at night by the cleaners or there was a bad leakage.

It sometimes developed that the outside temperature was such that a tenant would have part of his radiators shut off, and during the night the outside temperature would take a decided drop, so the number of radiators turned on was insufficient to properly heat this space. In such case I placed the burden on the tenant, again causing him to exert himself by turning on the balance of his radiators. If steam enough was put in the lines to heat rooms with only part of the radiators turned on, other rooms with all radiators on would be overheated and windows opened.

PRESSURE REQUIRED TO GET STEAM TO LOWER-FLOOR RADIATORS.

There is one condition that I have not been able to remedy, and will put it up to engineers who install heating plants to find

the remedy. Our steam risers are fed by a main at the top of the building. During mild weather, when just a little heat is needed, it sometimes occurs that to get steam through the radiators on the two or three lower floors, a pressure must be put on that gives the upper floors more than is needed. In such case we find it best to put on a heavy pressure for a short time and then shut it off, and in such case, to avoid overheating, frequent reading of the temperatures was taken.

I had one experience that established the value of shutting off steam at night that may be of interest. One of our tenants who occupies considerable space was furnished heat up to 11 p. m. on a cold night, because of an annual stockholders' meeting. To get heat to his rooms we, of course, were obliged to turn steam into all lines, and daily meter readings showed us that the incident had cost us $50.00.

MEANS FOR COUNTERACTING EFFECT OF VARYING WINDS.

The direction and velocity of the wind affects the heating of a building to quite an extent. For instance, during a cold wind from the northeast, we find to heat that side of the building normally the opposite is overheated and vice versa. To regulate such a condition I recommend a division of the building into sections by installing valves in the main supply line at the top of the building that feeds the risers, so that each section can be governed independently.

One year ago I was firmly convinced that a two-pipe system controlled by thermostats was the most economical for use in office buildings, and I think even now that such a system comes the nearest to being foolproof, but after my tests of the past winter I lay special stress on the care given the equipment and intelligent operations rather than the type of the system.

Many buildings have large amounts invested in heating plants and fool themselves by having a so-called "handy man," often of very inferior intelligence and judgment, in charge. No matter whether the heating plant is the isolated plant or whether steam is served from a central service, the same intelligent operating care is essential to attain economical results.

CENTRAL STATION VS. ISOLATED PLANT OPERATION.

There is probably no problem connected with the operation of office buildings which has been the subject of so much controversy as the question of central station versus isolated plant operation.

Representatives of central plants argue that because of very much larger generating units, they can furnish current cheaper than the isolated plant because of its smaller and less efficient units.

The owner of the isolated plant, however, claims that by making use of his exhaust steam he heats his building at no cost at all, which he claims brings his service below the cost of the central service.

The problem, however, is one that cannot be so simply disposed of, as there are many factors that bear directly on the subject that I must leave to the technical engineers to explain. sideration and worked out according to the requirements of each individual building.

The quantity of steam and electricity needed to supply the buildings equipment for light and heat.

The quantity, if any, of live steam that must be added to the exhaust for heat in winter and the quantity of exhaust steam wasted in summer.

The rates charged for steam and electricity is a very important factor.

Most isolated plants have very little definite information about the heating requirements because the exhaust steam which they use is not metered in any way. The ordinary isolated plant, having a large surplus of steam, is very generous with its use for heating and does not find it necessary to put into use the economical practices that have been mentioned. If it is equally as generous with the steam purchased from the central station it will very quickly waste the saving it should make. The point to be especially noted is that whereas the isolated plant can effect no saving in the operation of its heating system, it can, by the use of central service, make a very material saving, as is shown by my operating figures.

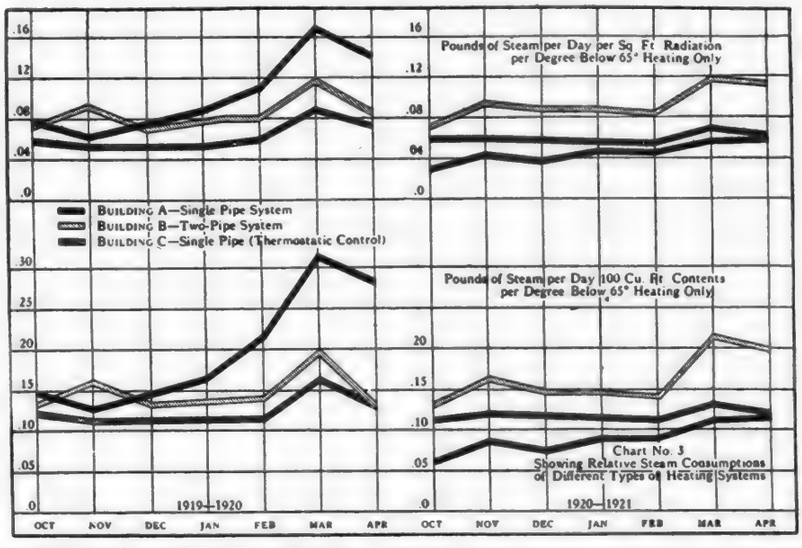

Pounds of Steam per Day per Sq Ft Radiation per Degree Below 65° Heating Only
BUILDING A—Single Pipe System
BUILDING B—Two-Pipe System
BUILDING C—Single Pipe (Thermostatic Control)
Pounds of Steam per Day 100 Cu. Ft Contents per Degree Below 65° Heating Only
Chart No. 3
Showing Relative Steam Consumptions of Different Types of Heating Systems
1919—1920
1920—1921
OCT NOV DEC JAN FEB MAR APR OCT NOV DEC JAN FEB MAR APR

CHART NO. 3—RELATIVE STEAM CONSUMPTIONS OF DIFFERENT TYPES OF HEATING SYSTEMS.

This is very clearly brought out by records of the Illinois Maintenance Company of Chicago, which show that in every case where they have taken over an isolated plant, the first year they use a very large amount of steam for heat, but as they learn to operate their system with economy they succeed in reducing their steam consumption very largely.

It is also shown by statistics that high cost of coal and labor makes the central service more desirable than the isolated plant.

I think only in the isolated plants supplied with the newer and more efficient equipment and with low coal and labor cost it is possible to compete with central service with efficient operation and equitable rates. All new buildings would make a decided saving by the use of central service, thus avoiding the investment charges needed for the installation of an isolated plant.

With central service a new building saves a considerable space that can be put to other valuable use, saves a vast amount of expense and trouble in operation, effects a very material saving in insurance, and enjoys a condition attended with less dirt and smoke. The item of smoke in the downtown section of many cities is a serious matter of much concern to all inhabitants of downtown buildings, especially dry goods merchants who suffer constant losses in damages to goods on their shelves due largely to smoke.

To some extent each building has problems in heating peculiarly its own, but the same care in general operations is needed in each, no matter what type of heating system is installed.

To tighten all leaky windows, secure the co-operation of tenants in economical practices and to put just enough steam in the system to keep the temperature at 68° or 70° with windows closed, and radiators functioning at their maximum, is to my thinking needed for economical heating.

A PROGRAM FOR SMOKE PREVENTION AND FUEL CONSERVATION

Details of a Proposed Block Plan of Heating, Together with Municipal Ownership and Operation of Gas Plants

BY E. VERNON HILL.

THE writer remembers, when a young man, hearing for the first time that old war-horse of republicanism, Chauncey M. Depew, speak in behalf of the candidacy of William McKinley for president. The speech was for a broader patriotism and a high protective tariff, and his closing sentence was as follows: "And mark you, my friends, we shall be prosperous as a nation so long as the smoke curls upward from the chimneys of our factories and no longer." However, we do not have to go back a quarter of a century to find people who believe that a dense, black cloud of smoke hovering over a community is a necessary adjunct to industry and prosperity.

Happily, however, the number holding this viewpoint is constantly diminishing.

The educational work carried on by health agencies and other institutions throughout the country has brought the majority of the public to a clearer realization of the facts in the case. The ordinary methods of firing bituminous coal are now recognized as extremely wasteful and the smoke emited from the chimneys smudges our buildings and clothing and destroys enough property so that when the actual cost is shown in dollars and cents the amount is appalling.

Harold Almert, chairman of the Fuel Conservation Committee of the State of Illinois, during the late war, compiled statistics showing that the annual loss to Chicago alone from the smoke nuisance amounts to approximately $75,000,000. This amount is divided up as follows:

$35,000,000 loss occasioned in the cost of coal alone that is wasted when it is improperly burned, producing smoke.

$40,000,000.00 is the loss and damage to property, clothing, increased laundry and cleaning bills and other damage of this kind resulting from dirty air.

IMPORTANCE OF PROBLEM FROM A HEALTH VIEWPOINT.

But the campaigns waged for years past on the basis of financial loss and general nuisances from smoke have not been entirely successful. There is a stronger appeal that can be made for smoke elimination, this is from the health aspect of the problem. Smoke is something more than an objectionable condition from the aesthetic or commercial viewpoint. It is a positive factor in increasing the prevalence of certain respiratory diseases. Some of these are caused directly by irritation of the delicate structures of the bronchial tubes and lungs, by inhalation of the carbon particles, producing a distinct clinical entity or disease known to medicine as anthracosis. The cause of this condition primarily is irritation from the inhalation of coal dust and soot in the air. The respiratory or breathing mechanism of our bodies has several lines of defense with which to combat the intruder: First, the hairs within our nostrils that act as a filter in removing the coarser articles. The cilia or hair-like process in the bronchial tubes catch a large portion that passes through the hairs in the nostrils. These cilia have an undulating or waving motion which carries the particles forward toward the mouth, thus aiding in their final elimination.

The second line of defense is the mucous cells lining the breathing tract. They secrete a mucoid substance which aids in the battle against the invader, taking up the small particles and expelling them into the mouth as a dirty, grayish or blackish sputum. When the invading substance is too powerful for these two lines of defense the carbon particles penetrate into the lung substance, discoloring it permanently a slate gray or almost black. The mere staining of the lungs is not necessarily serious, but this is the third line of defense and a continuation of the invasion results in further injury to the tissues, finally overcomes the balance and produces disease. The diseases resulting from this irritation are interstitial pneumonia, or hardening of the lungs, chronic bronchitis, that is chronic catarrh of the air tubes, and a dilatation called emphysema, with resulting loss of its normal elasticity. Not only does inhalation of smoke produce these diseases as a direct result but by irritation and breaking down the resistance it paves the way for other serious infections, such as influenza, pneumonia and that most dangerous of all enemies, pulmonary tuberculosis.

The smoke-laden atmosphere has another effect that is also serious. The pall of smoke overhanging the city shuts out a large portion of the sunlight, which is the great germicide. The smoke produces a haze or fog, according to its density, and in this way exerts a noticeable influence on the death rate. There is an old saying which has been repeatedly demonstrated by experience, that a red sun means a high death rate and a red sun is the result of dust and dirt in the atmosphere.

When the people as a whole have been brought to a proper realization of the seriousness of the smoke problem, not only from the standpoint of financial loss to themselves but from the health standpoint as well, there will be much better co-operation in the program that is submitted.

PRESENT METHODS OF SMOKE PREVENTION.

The present methods of smoke prevention are being directed toward three agencies, the three "F's" in the smoke problem:

1. The furnace.
2. The fireman.
3. The fuel.

Combustion engineers throughout the country have made careful studies and experiments with regard to the proper design of furnaces for burning bituminous coal, with the result that there are any number of such furnaces on the market that *can be* operated without producing smoke while burning, for instance, such a fuel as Illinois coal.

The second factor in our problem, namely that of the fireman, remains unsolved, and so long as human nature is as it is our difficulties will always be present. We exclude, of course, large power plants with automatic chain grate stokers and proper supervision. In the smaller plants, both power and heating, where hand-fired furnaces are in use, the problem of the efficient fireman will never be solved. Even though the furnace is properly designed and can be operated smokelessly, assuming that it is clean and in proper operating condition and that the fireman is intelligent, conscientious and careful, we will never have uniform, smokeless operation from this combination. The educational campaigns supplemented by individual instructions to the fireman on how to operate his equipment smokelessly have not brought the results anticipated. The constant labor turnover makes the educational work necessarily continuous and both funds and perseverance fail.

This brings us to the third factor, namely, that of fuel, and I feel that it is a safe statement to make that the smoke problem in cities where bituminous coal is now used will never reach a sat-

isfactory solution until the small hand-fired furnace is eliminated and some form of district heating substituted.

SUGGESTED PROGRAM.

The writer has, therefore, suggested a new program of smoke abatement, or perhaps we should say an amplification of the present program, which consists of four successive steps which when completed will give us a permanent and satisfactory solution:

1. Continuation of present activities.
2. Extend the use of coke for domestic purposes.
3. Encourage the adoption of the block plan of heating.
4. Municipal ownership and operation of gas plants.

1. *Continuation of the present activities:*

This is imperative as any relaxation in our present energies will immediately result in a marked increase of the smoke nuisance. The present methods may be summarized briefly as follows:

(a) Careful supervision of the installation of all new furnaces.

(b) An educational campaign conducted through engineers' and firemen's organizations, janitors' unions, railroads, etc., on the proper method of firing to eliminate smoke.

(c) Smoke inspection work of observing violations and penalizing offenders by court action and fines, or by summary closing down of the plant.

2. *The use of coke:*

Coke as a fuel for use particularly in domestic heating plants is a possibility that has not been developed. Kreisinger and Fieldner in a Bureau of Mines bulletin state "Coke should be used for heating houses because it is a clean and convenient fuel, it eliminates smoke, reduces the necessity of cleaning the furnaces and flues, requires less attention than coal and gives a more uniform temperature in the house. By burning coke for domestic heating more soft coal will be used in bi-product plants, which save many valuable bi-products that are wasted when the coal is used directly in the raw state." The bulletin tells how to burn it in a house-heating equipment and these rules may be summarized as follows:

1. Carry a deep bed of fuel, a bed about 18 in. thick gives the best results.
2. Us very little draft after the fire is started and keep it always under control.
3. Do not stir the fuel bed. Clean the fire in the morning if possible.
4. Use sized coke ½ in. to 2 in. for furnaces, boilers and stoves; ½ in. to 4 in. for open grates.
5. Do not allow ashes to accumulate in the ash pit.

COST OF COAL VERSUS COKE.

What about the cost of coal versus coke? The prices of fuel delivered at the building (in Chicago) to-day are about as follows:

Anthracite, $15.25 per ton (B. T. U. per pound, 12500) Cost per 1,000,000 B. T. U.	$ .61
Coke, $13.25 per ton (B. T. U. per pound, 12,600). Cost per 1,000,000 B. T. U.	.525
Pea-size coke, $9.50 per ton (B. T. U. per pound, 12,600). Cost per 1,000,000 B. T. U.	.377
Pocahontas, $8.95 per ton (B. T. U. per pound, 14,500). Cost per 1,000,000 B. T. U.	.309
Franklin County, $7.25 per ton (B. T. U. per pound, 12,000). Cost per 1,000,000 B. T. U.	.302

From the foregoing it is apparent that anthracite is the most expensive fuel; even so, it is extensively used in Chicago at the present time by those who refuse to endure the muss and dirt from bituminous coal. On the basis of heating value Franklin County coal is the cheapest, but if we consider the difference in the efficiency of coke and Franklin County coal the discrepancy is not so great. The Engineering Experiment Station at the University of Illinois made comparative tests of the use of coke and coal with the following results:

Bi-product coke's efficiency in boilers and furnaces	61.63%
Anthracite	51.93%
Illinois coal (Williamson county)	48 %
Pocahontas coal	46.5 %

Viewed, therefore, on an efficiency basis Illinois coal would cost 65c per 1,000,000 available B. T. U., and bi-product coke 85c. Pea coke would be 61c or cheaper than the cheapest bituminous. By mixing pea coke and the larger sizes it is evident that even with the present inexcusably high price of coke there is no cheaper or better fuel available, when we take into consideration that we obtain a smokeless fuel, eliminating dust and dirt, the cleaning of boilers, smoke pipes and flues. It is plainly evident that coke has a distinct advantage over the other fuels mentioned for domestic purposes.

3. *Encouraging the adoption of the block plan of heating:*

The third step in the program is to fost and encourage in every way possible the adoption of some form of central heating to replace the smoking and inefficient individual plants that are in operation at the present time.

There are two methods of district heating that should be given consideration, one is the present practice of serving areas of approximately one square mile or even more. The second proposition is to limit the service to a single city block. It is unquestionably true that from the standpoint of efficiency, service to larger arears is desirable, but there are many features that make the block plan the one of choice, at least in such localities as Chicago at the present time. The latter system requires no franchise, no permits to tear up pavements or to tunnel beneath the streets; no material expense is involved in laying long conduits, and the installation could be made by block-units in selected districts at a low initial cost and service given with a reasonable overhead for maintenance and upkeep. At some future time when the number of block units become sufficiently numerous they could be connected in such a way as to equalize the load and the service and probably increase the efficiency. It is not the writer's purpose to argue that the block plan is superior from an engineering standpoint, but, all things considered, it is probably the most practical method of approaching the problem.

The trend of the times is toward specialization and a division of labor. The housewife, if the term is not obsolete, no longer bakes her own bread, makes her own clothing or that of the family, or even does her own laundry work, except in a minority of cases, and it is unreasonable to suppose that the troublesome and inefficient individual heating plant will long survive when there are many valid reasons for its elimination.

A central plant in each block could be constructed along modern engineering lines, with apparatus and equipment that will insure not only smokeless operation but the highest possible efficiency. The block power house would, moreover, be more than a heating plant. A service is contemplated to care for the garbage and refuse from the buildings in the block and the general janitorial service. This house service is a very important part of the plan.

The desirability of such a system is apparent: Heat and hot water uniform and available during all hours of the twenty-four; garbage disposal each day, no cans in the alley (this would be the greatest step possible toward the elimination of the unsightly alleys at the present time, and the rat pest and fly nuisance); waste paper would receive immediate care and this nuisance abated; basements would be materially improved through the abandonment of coal storage and coal burning; damage and loss due to coal individual delivery would be stopped and a material saving effected in the cost of such deliveries; material reduction in the fire hazard in such blocks would be another desirable result of the system, and a corresponding reduction of insurance rates; improvement in grass, shrubbery and tree growth, and, finally, the elimination of dirt and the

injection of a modern, efficient system into house service, together with improvement in the desirability and the value of existing apartments where such service is installed. These and many other desirable features make one enthusiastic when discussing the problem.

The accompanying survey of a city block in Chicago may be taken as an indication that the method is beginning to receive proper recognition, and it is not, we feel, too much to hope that in the near future we will have actual work under way.

Report on Block Steam Heating in Chicago, Ill.
(55th Street, 56th Street, Everett Avenue and Hyde Park Boulevard)

Investment		$34,207.95
Heating Income	$36,029.50	
Operating expense, depreciation and fixed charges	32,130.37	3,899.13

Or about 7% on investment and 4% sinking fund.

Boiler Plant.—The customer's hourly steam demand under maximum conditions will be approximately 9,476,500 B. T. U. to which must be added line loss, boiler room usage and unaccounted for losses. We have selected with a view to easy standardization and duplication of equipment for this service three 66-in. x 16-ft. horizontal tubular boilers rated nominally at 100 H.P. each and equipped with hand-fired furnaces. Auxiliary equipment, ash and coal handling machinery, are all of the simplest type in order to reduce the necessary investment as there is no call for expensive equipment in a plant of this size, for labor cost will not materially reduced with automatic stokers, coal and ash-handling machinery, etc.

Steam is to be generated at 100 to 125 lbs. and admitted to the medium-pressure distribution system through a reducing valve, being further reduced in pressure at the entrance to each building served.

Building Equipment.—No alteration in the existing equipment in each building is contemplated beyond the making of connections to the present supply mains with necessary valves and the

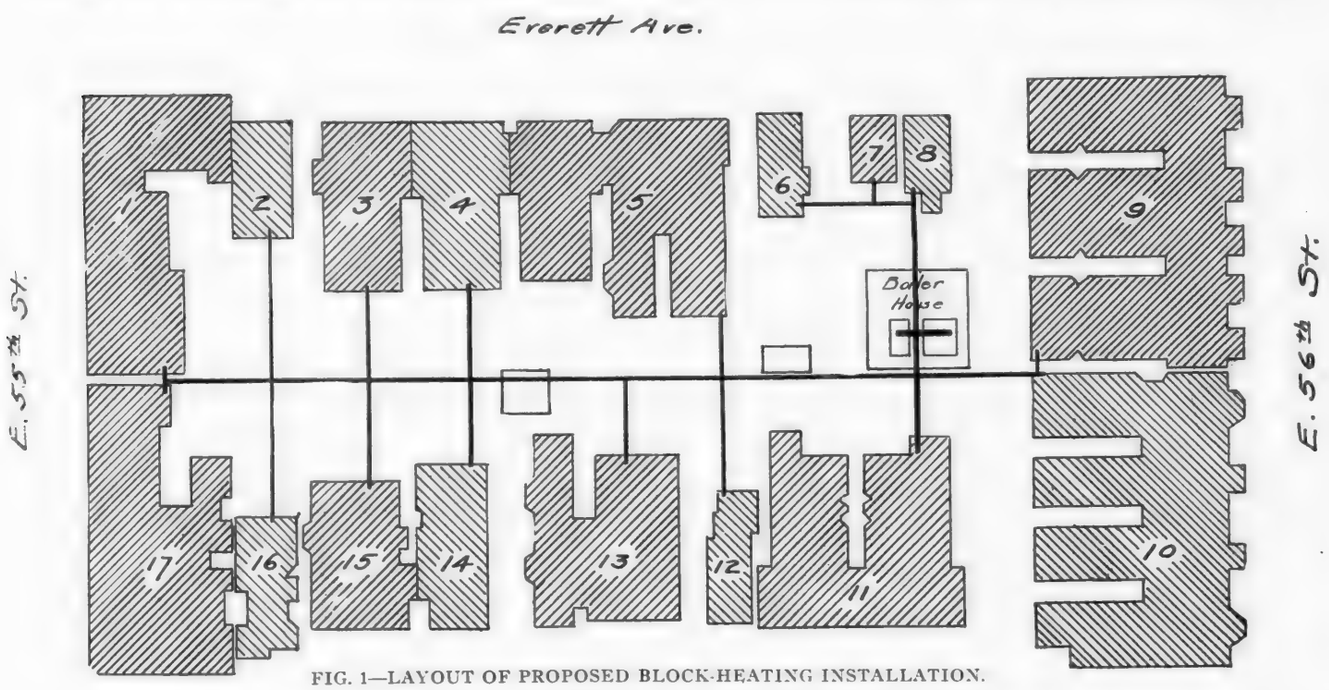


FIG. 1—LAYOUT OF PROPOSED BLOCK-HEATING INSTALLATION.

District.—In the block contemplated in this operation there is but one class of building, namely, apartment houses. The heating period is contemplated for 24-hour service each day and the heating load is calculated on the basis of climatic conditions prevailing in Chicago during eight months annually for the past 36 years, including the average wind movement during the period.

Construction.—No value for real estate occupied by the boiler plant is included in the figures, but it will be necessary to make arrangements with one or two property owners for the necessary space and it is intended to use horizontal tubular boilers of standard construction for operation at safe working pressure of 125 lbs. The distribution of steam to the buildings is through an underground medium-pressure main and a return line for delivery of all condensation by gravity to the power plant is included.

Total steam to heating system.

Customers		31,330,000 lbs.
Unaccounted for, 10%		3,133,000 lbs.
Steam main losses		255,860 lbs.
		34,718,860 lbs.
Boiler room usage, 5%		1,735,943 lbs.
Total steam generated		36,454,803 lbs.

placing of traps and meters on return. It is sometimes quite advisable to make alterations in building plant to promote efficiency and reduce operating expense, but these changes are properly for the benefit of the owner who should stand any expense thereby involved.

No figures are included for heating the water for domestic supply or for cooking purposes, etc., but it is probable that this service can be arranged for on a special basis and become a very popular part of the usage, perhaps even to the extent of warranting 12-month operation of the boiler plant, instead of merely the eight months required for the heating season.

Investment.—Underground steam supply mains, returns, trenching, etc. (Return mains total dollars $2,271.10 incl.) $16,408.35
Boiler house, boiler auxiliaries and chimney 13,600.00
Customers connections 4,199.60
$34,207.95

The item of the cost for return mains is set forth in the above tabulation as it is questionable whether this expenditure is justifiable in this case. However, popular opinion, not always well informed, seems to be insistent on condensate return. Hence the item above mentioned is set out for the purpose of check against water valuation of condensate, as desired.

(To be continued.)

FUEL ECONOMY IN HEATING SERVICE

Comments on Present Practice in Down-Draft Boiler Design, with Suggestions for Improvements

BY A. BEMENT.

EFFICIENCY in heat transfer is a matter of temperature; the higher the temperature, the more effective the transfer from the coal to the water in the boiler. To get this point, it is necessary to realize the distinction between heat and temperature.

For illustration, a banked fire may smolder away and all burn out while no steam is made; in fact, the pressure may fall during the time. On the other hand, an active hot fire will make steam. Thus, in one case the heat is generated at a high temperature, and can flow into the water in the boiler; in the other it is generated at so low a temperature that it is not as hot as the boiler, hence it all must escape to the chimney.

The cause of heat generation at different temperatures is a matter of air supply. Excessive air results in what may be called a cold fire, because the heat is distributed into a large mass of gas, consequently can not raise it to a high temperature. On the other hand, with a proper minimum air supply the same quantity of heat is distributed in a small amount of gas, resulting in a high temperature. Thus we have the distinction between a relatively hot and relatively cold fire. The hot fire makes for economy, the cold fire for extravagance. This being true, it necessarily follows that for economy a strong hot fire is essential, or in other words a good fire.

HOT FIRE SHOULD ALWAYS BE MAINTAINED.

With small loads on boilers, such as in mild weather, a hot fire will make more steam than required, or with a water heater, will overheat the water unless controlled. This implies that the draft should be properly regulated by dampering. Draft control is one of the important essentials for fuel economy.

According to the foregoing, a hot fire should always be maintained, but the speed at which it burns should be in proportion to the needs for heat. If much heat is required, the fire should burn proportionately fast; if little heat is needed, the same strong fire is burned slowly. So, the same good fire is always essential, but the speed at which it is burned should bear a definite relation to the demand for steam.

Then it follows that the steam pressure gives information for draft control, and the appearance of the fire shows when fuel is to be added. This is quite the reverse of general practice, in which the boiler is "fired up" when the steam gets low, and the fire allowed to die down when pressure gets high, or when little heat is needed. Therefore, as the fire burns down, it should be replenished, disregarding steam pressure, since draft control takes care of pressure entirely. This is a matter so at variance with common practice that it is necessary to give it due consideration for proper appreciation.

TWO TYPICAL EXPERIENCES.

Some illustration will help to a better understanding and two cases may be cited. In one instance, two boilers were used in factory heating. In prevailing practice both were in service, with dampers and ash-pit doors fully open, and firing was according to steam pressure. As steam fell coal was added. Under this condition 671 lbs. were used per hour. When one boiler was used, with the same full draft, a hotter fire resulted and the coal consumption was 400 lbs. per hour. With one boiler in use, stack damper closed down, one ash-pit door closed and the other open part way, the consumption was 291 lbs. per hour. In this latter condition, as the fire gave evidence of burning down, coal was added to bring it back to normal. As pressure fell the ash-pit door was opened a little way. As pressure rose this door was closed a little. The heating load was the same in all these three conditions.

The other case was that of two water heaters, each with the same load; in other words, each performed the same amount of work in heating water. The heaters were of the same kind and make, and all operating conditions were the same, except that one had damper and ash-pit door fully open; the other was operated with draft control. The one with controlled draft burned a little less than half the amount of the same kind of coal that the other required to do the same work. With the full draft the fire was replenished four times, and the CO_2 ranged from 4 to 6. With the controlled draft, one firing served for the whole period of the test, and CO_2 ranged from 14.5 down to 12.5.

Draft control, both automatic and otherwise, is now very generally provided, but in its mechanical condition and use, does not generally conform to the requirements outlined in the foregoing, because the good fire is not maintained all the time, and the damper equipment is often inefficient.

IMPORTANCE OF ASH, CLINKER, SMOKE AND INCOMPLETE COMBUSTION.

Having outlined the essentials for economical heat production it is next in order to consider their application in practice, and two important features must be dealt with. One is ash and clinker, the other smoke and incomplete combustion. With the common fire-grate the attempted maintenance of a good fire all the time would be productive of excessive clinker formation, making it not only difficult but impossible to clean the fire without allowing it to burn down, which would result in waste of fuel. It is necessary that the fire be cleaned and at the same time that it be maintained in its economical condition; in other words, that it be cleaned without its being disturbed, so to speak. This is something that, generally speaking, is not possible with equipment now in use in heating service. In the power field, however, equipment is available which makes it possible to do this. With the underfeed stoker, coal is forced in under the fire, which burns upward. The ash, taking the same path of travel, is forced out of the fire where, in some forms of stokers, it is deposited to one side entirely outside of the fire. There, in the form of clinkers, it may readily be removed without in any way disturbing the fire. This form of device, of course, is not at all suited to the service with which this article deals, but it serves to illustrate the process.

Another design, which has been extensively used in power work and which fulfills the requirement in question, is the down-draft furnace, which several manufacturers have attempted to copy and apply to heating service. In doing so, however, in most cases the essential principles of design and operation have either not been understood or else ignored.

REQUIREMENTS THAT SHOULD BE MET IN DOWN-DRAFT DESIGN.

In operation, the down-draft fire burns downward, the coal being placed on the top. Combustion proceeds from top to bottom and the gases pass through the water bars on which the fire rests, the travel of the ash taking the same course, lodging on the bars. These bars are necessarily a considerable distance apart, so that the ash and clinker can fall through these openings when loosened and dislodged by a slice bar, so inserted that it deos not disturb the fire. This requires openings at the front of the furnace, in such a location that the bar may be in-

serted at a position at the top of each water bar so that the slice bar will pass under the fire without disturbing it. The bar should be run to the back of the furnace at each water-tube, in this way dislodging the ash and clinker to the lower grate. This slicing should be performed at each firing period, the slice bar being run clear to the back at every water-tube. In this way the fire may be kept clean and in a condition of maximum efficiency. In case fine or coking coal is used which sticks together in the fire, the fuel bed can be opened up by slightly raising the slice bar, care being taken not to seriously disturb the fuel bed and poke down too much fire. The main purpose of the slicing is to poke out the accumulated ash before it fuses into large clinkers.

The lower grate onto which the ash falls should be one of plain grate-bars with very small air openings, because, in addition to catching the falling ash, all it needs to do is to burn the few hot coals that fall with the ash, and to furnish a very small supplemental air supply to the burning gases as they come from the grate above.

The ash-pit below the lower grate requires but shallow depth because, as explained later, most of the ash should be removed directly from the lower grate.

The fire box, the space above the water-bars, should be of considerable depth, and the firing door should be as high as the top of the fire box, or coal chamber will allow. This is so that a deep fuel bed may be used. Thus the fuel chamber should be large enough to insure a depth of fuel that will not only make an efficient fire, but insure a long firing interval; and the fire door should be high enough so that the coal will not roll out of the door.

An air opening in the fire door, controlled by the damper regulator, should be used, of course, but such opening in the door of the lower grate is not required because better results are had by way of the ash-pit, through suitable adjustable openings, in it.

PROPER OPERATION AT FIRING PERIODS.

Proper operation of the foregoing equipment at firing period is as follows:

1. Open door to lower grate and rake out surplus ash and all clinker, leaving a portion of the ash. The ash will fall from the water bars as loose ash and small clinkers, and should be removed.
2. Insert slice bar, dislodge ash from the bottom of the fire and, if necessary, loosen up the fire slightly.
3. Open door to the lower grate and level the ash and coals that have been poked down from above. This leveling should be done carefully with a hoe so that the coals and ash will be uniformly spread over the entire surface of the grate. The coals will then burn away evenly, and the ash bed will distribute the air uniformly, the idea being to always carry some ash on the grate, but not enough to be an obstruction.
4. Refill the fire box with coal sufficient to carry till the next firing period.
5. Keep the ashes out of the ash-pit.

DOWN-DRAFT BEST SUITED FOR COMPLETE COMBUSTION IN HEATING SERVICE.

For producing complete combustion, by which is meant the burning of the volatile gases distilled from the coal, there are two general types of equipment in use in power service. One of these consists of a large chamber, lined with fire-brick, in which the gas flames remain long enough to burn. The other system has two examples, but both embodying the same principle. One is that of the underfeed fire, the other the down-draft fire. In each of these, the freshly-distilled gases are compelled, together with the air, to travel through the hot bed of coals, where gas and air become thoroughly mixed together in this hot zone, resulting in immediate combustion. Neither the chamber, or underfeed fire are suited to heating service. The down-draft fire is, however, well suited to such service, because it is a hand-fire device, while the others require either mechanical operation, or volume of apparatus entailing first cost and expense of operation which is prohibitive in usual heating service.

OBJECTIONS TO DOWN-DRAFT FURNACES.

Objection has been made to the down-draft furnace because it has a very short firing period, is inefficient in the use of coal, and difficult to operate, which is true of the device as usually made. But if correctly designed so that it could be properly operated, it would have a longer firing period, be more efficient and be easier to operate than any furnace using bituminous coal now made.

POINTS AT FAULT IN DOWN-DRAFT DESIGN.

That it may be understood why down-draft furnaces have failed to give satisfaction, it is well to call attention to some of the points in which they are at fault. In one design which afforded fairly good opportunity to use the slice bar to poke down the ash, not all the water bars were accessible, so clinker formed on these, but those that can be poked may be kept clean. The fire-box, or fuel chamber, however, is so shallow that it is impossible to get a sufficiently thick fuel bed to satisfy the air supply. The result is that it is impossible to get a good fire as the heat is carried to the chimney in an excess of air, and while the furnace will burn a lot of coal it makes but little steam, consequently has low efficiency and a very short firing period.

Another example has a fairly deep fire-box, but no means for slicing the fire for removal of ash, other than by digging down through the fire from the top through the fire door. As this results in spoiling, or "losing the fire," attempted removal of the ash is neglected, with the result that serious clinkering obstructs the fire.

The tendency has been to over-estimate the importance of the lower grate, with the result that it has been designed as if it were to be used to burn all of the coal. It has been made to be shaken, and the space above it made higher than necessary, also the ash pit has been proportioned as in ordinary boilers. This has led to giving these features more room than necessary, with the result that in an effort to get a boiler that would go in low basements, the fire-box or fuel-chamber capacity has been sacrificed.

SHAKING GRATES NOT NECESSARY.

The use of a shaking grate is entirely out of place, as only a very small amount of coal should be burned on it. The slicing of the fire above should only dislodge a small amount of live coals, and no green coal should be poked down. The purpose of the slicing is only to dislodge the ash, and to loosen the fuel bed if necessary; therefore a smooth flat grate is best.

WASTEFULNESS OF INTERMITTENT FORCING OF FIRE.

One of the factors affecting economy in heating service is the character of the load. It is quite common practice "to fire up" as heat is required, then let the fire burn low and the pressure fall to nothing. Then when the temperature of the house or apartment gets low, to fire up again. This practice results in an inefficient fire most of the time, and, while a small amount of steam is made, it is at the expense of much fuel. This practice has been brought about largely in apartment houses where carrying steam all the time has caused overheating, with the result that tenants open windows to cool off. To cure this habit, steam supply is kept at a minimum, although fuel consumption may be at the maximum. At all events, it is greater than it should be.

The writer has in mind a case of an apartment house owner who has a very efficient furnace, under perfect draft control. Full pressure is carried all the time, night as well as day, and his instructions to the tenants is to open the windows if it gets too warm, which they do. Under these conditions only two firing periods are necessary in 24 hours in coldest weather, and the owner brags about his low fuel consumption. This does not mean, of course, that it is good practice, but serves to show how wasteful the intermittent practice can be.

REMEDY FOR THE WINDOW OPENING HABIT.

The reason people open windows is because it is easier than turning off radiators. Opening of windows, of course, leads to uneconomical furnace operation, with the whole proposition out of joint. The cure is to fit radiators so that it is easier to turn them off than it is to open windows, or use a system allowing fractional control of steam supply to the radiators. Under such conditions steam may be carried all the time, the heat from the risers furnishing all the warmth needed in much of the mild weather. A furnace working as above described would operate for two or three days on one firing. It will be helpful in understanding the argument, if one will recall how many times he has heard the remark made that about as much or nearly as much fuel is required in mild as in cold weather.

HUMIDIFICATION POSSIBLE WITH CONTINUOUS STEAM PRESSURE.

Another important advantage in carrying a continuous steam pressure during the day and evening, is that it makes humidification possible, and as moistening the air results in comfort at a lower temperature, radiation losses are much lower. This, in itself, is an important fuel saving. The heat in the steam used for humidifying is imparted to the air of the apartment, and has the same heating effect as though it were condensed in the radiator instead of in the air of the room, so that it heats and humidifies at the same time.

That there is an important saving in fuel made by carrying a lower temperature, as against a higher, is of course obvious. If we should not heat at all, we could save all the fuel, so it is apparent that there is a wide range in fuel requirement for different indoor temperatures. Experiments determining radiation loss through walls of buildings affords information but probably the most convincing evidence is given by tests made by the Engineering Experiment Station of the University of Illinois. During the late war people were urged to carry low indoor temperatures, as a means of fuel conservation, and to show the possible saving, a test was made. Two houses, exact duplicates, were built for the purpose; one kept heated at 68° F., the other at 75° F., and it was found that 25% more fuel was required to maintain the 75° than was used to maintain the 68° temperature. But no person would be willing to live in a 68° temperature unless the air was humidified, because it would be too cold, so to obtain the advantage of the 25% saving it is necessary to humidify.

SOME PRACTICAL EXPERIENCES WITH OZONE

Observations of Its Effect in Ventilating Work, Both as a Health Tonic and Fuel Saver

THE statements here made are based on a winter's observation of over 100 portable-type ozone machines, in 74 installations. These installations include five public utility offices, ten general business offices, eight banks, seven factory offices, eleven residences, seven stores, one Y. M. C. A. locker room, two restaurant kitchens for destroying cooking odors, one hospital dormitory, one garage shop, one willow ware shop for destroying banana oil odors, and one creamery.

The machines were placed for a great variety of air-freshening requirements, from the correction of stuffy, uncomfortable atmospheres to the elimination of odors from cooking, raw hides, sweaty garments in locker rooms, odors from banana oil (anyone with experience in bronzing hot radiators with this material will appreciate what this is), from tobacco smoke, the odors from gas-engine exhausts and gas heaters discharging combustion products into breathing spaces, bedroom odors, and laundry odors. In addition to observing the effects of ozone machines installed for the purposes stated, an attempt was made to ascertain if sleeping in ozonized air did not give a greater feeling of vigor than sleeping in outdoor air on sleeping porches. This was demonstrated in three cases.

MACHINES INSTALLED ON TRIAL.

The ozone machines were all placed on trial for a period of from 30 to 90 days, with acceptance subject to the decision of the prospective purchaser from his estimate of benefits received, and subject to return, without question, if the prospective customer so elected. Demonstrations have not yet been completed in the garage shop, the willow ware shop, the hospital dormitory, one church and one hotel.

Of 114 machines installed, 26 have been returned. As this work has been carried on during a period of great business depression, this will no doubt account for some of the returns.

From a belief that ozone was simply a deodorizer of great power, the writer's experiences with its use has brought the conviction that it is at least one element of our atmosphere vital to health. It is to be hoped that others in a position to do so will make the same kind of trials as are here reported, so that, if the facts warrant it, wide use of this gift of nature will evolve correct principles for its application, in the same way that our knowledge of the principles governing the use of water, steam, gas and electricity has been acquired.

INSTALLATIONS IN ST. LOUIS.

At the January, 1920, meeting of the American Society of Heating and Ventilating Engineers, E. S. Hallett, chief engineer of the St. Louis Board of Education, presented a paper on "An Advance in Air Conditioning in School Buildings," in which he stated that he had found in the St. Louis schools, where the standards of ventilation were considered very good, the same complaints as were reported in other cities, and which the complacent ones attributed to poor design or operation of the mechanical ventilation systems. Mr. Hallett corrected his trouble by adding ozone to the air that he recirculated within his buildings, relying principaly on leakage for fresh-air make-up. As a by-product, he halved his fuel costs.

OZONE NOT PRESENT IN CITY AIR.

Mr. Hallett's paper carries this significant statement which seems to have received but little attention; "Ozone is not present in the air of cities because it is quickly consumed by the decaying matter and other oxidizable substances. It must now remain an undisputable fact that human beings require ozone as a normal constituent of the air, and the artificial supply of ozone is nothing but supplying the missing element which has disappeared, due to the results of dense population."

Mr. Hallett says further: "To sum up the results of a year's tests with ozone in the schools, the following facts are indicated. Ozone does destroy all odors resulting from the respiration, bodies and clothing of children. It produces a mild exhilaration resembling that of a sea breeze or the air of the morning after a thunderstorm. It destroys toilet-room odors. When used in a

proper concentration for ventilation, it has no odor itself. It reduces weight in persons corpulent from inactivity. It appears from limited data to be a preventative of influenza. It is undoubtedly of great value in the treatment of influenza and pneumonia, as demonstrated in the influenza hospital in St. Louis last year. To this should be added the evidence adduced by the medical authorities of France that ozone increases greatly the oxyhamoglobin of the blood, thereby increasing the oxygen-carrying capacity of it. This, in turn, cures anemic persons. The introduction of ozone in ventilation would probably remove the necessity for open-air schools now common in most cities."

Another matter which Mr. Hallett refers to in his paper is that teachers who receive ozonized air can do more work in a day, with less fatigue, than when they received the former standard of 30 cu. ft. of outdoor washed air per minute. The writer has heard many similar expressions on the part of those who have benefited from the machines he has been observing.

It is significant that St. Louis, after having had fifteen schools equipped with ozone, has just contracted for five more schools to be so equipped. Each of these schools accommodates around 1000 pupils and the entire work is under rigid medical supervision.

TEST ON ENTIRE WINTER'S OPERATION OF TWO BUILDINGS.

A comparison was recently made between two buildings, for an entire winter's operation, the buildings being selected to give as nearly identical conditions as it is possible to get in two different buildings. One building, with a 1000 pupils, received outdoor air in accordance with the St. Louis standards. The other, equally large, received recirculated air ozonized. Records were kept of absences and causes of absence in both buildings by physician inspectors. The outdoor building showed over three times the number of pupils absent, with about 2½ times the number of days absent. The diseases that caused the absences were of even greater significance than the numbers.

The St. Louis research seems to indicate that our present standards of ventilation, with their great supply of outside air, are as wasteful as they are inadequate. Ozonation, however, does not necessarily mean recirculation, a fact that some of those who are doubtful of it on that account do not appreciate.

CO-OPERATIVE EFFORT URGED TO STUDY OZONE.

It appears to the writer that the time has come for less discussion and more action on the ozone question. It may be possible that the time is ripe for such a co-operative effort by the national organizations of the medical, engineering (meaning ventilating engineers), chemistry and electrical professions, as will establish the principles of correct ventilation.

EASY TO WORK WITHIN SAFE LIMITS.

Any engineer who is familiar with heating and ventilating conditions will have little trouble in working within safe limits in the use of ozone. Mr. Hallett states that he uses a unit with 600 points for the brush discharge for the ozone necessary for 1000 C. F. M. To this it can be added that this unit requires about 20 watts per hour for its maximum capacity. So, with an estimate of the C. F. M. necessary for a given operation, the selection of a machine of this type, with one unit for each 1000 C. F. M., will establish a safe working basis.

Very old duct systems may require nearly twice this capacity to oxidize the dust that has collected on inaccessible surfaces after years of service. Later on, the ozone production may be cut down. Of course, outdoor air supply, with continuous venting or wasting of the air, requires more ozone capacity than if recirculation is practiced.

As diffusion of the ozone is all-important, it follows that the central fan method of ventilation is the best way of applying it. Ozonation, it should be remembered, does not, in any way, mean any less use of mechanical ventilation.

The trained ventilating engineer, from his estimate of the C. F. M. he would use for the required duty, has the way pointed out to estimate the required ozone capacity by using one generator of the type of machine we are considering, for each 1000 C. F. M. Not less than 25% excess should be provided for odor-destroying work.

As Mr. Hallett has pointed out, the nose is the best instrument to use in checking ozone freshening. The idea is to introduce sufficient ozone so that its characteristic odor will be just perceptible to a nose that is brought in from the outdoor air. Any atmosphere that has a slight excess of ozone in it, just enough to be perceptible, to a nose brought in from outdoors, won't have anything else in it, providing, of course, that diffusion is as it should be.

What has been said shows that the problem is very similar to a heating problem. The required amount must be estimated, and then the ozone must be diffused uniformly throughout the space to be freshened, with no undue concentration at any point. Failure to comprehend this is responsible for practically all objections to ozone freshening, from a distress standpoint, for it must be remembered that just as water will drown, steam destroy and scald, gas explode or asphyxiate, or electricity burn, maim or kill if not used with understanding, so ozone is a powerful force for trouble, if it is used without regard for the principles of proper application.

WARNING GIVEN BY OZONE

Oxygen in excess is a poison in effect, yet it gives no warning. Ozone, on the other hand, may safely be used in any concentration until the nose distress warns that the limit has been reached. To settle this point the writer has been using in his own home, for six months, an ozone concentration heavier than he would care to recommend to any one else. His family, of a wife and five children, has experienced nothing but benefit.

IMPORTANCE OF DIFFUSION.

When it comes to the application of the portable type of machine, great care must be used to diffuse the ozone properly by the necessary consideration of the area of the space, its ceiling height and the duty. Here again, the C. F. M. estimate will help to determine the generator capacity, but enough units must be selected and so placed as to secure uniform diffusion. The lower the ceiling height, the more care must be exercised. In many respects the consideration is very much like locating radiators to secure uniform heating, with no low or high spots.

SINGLE UNITS FOR LARGE INTERIORS TO BE AVOIDED.

There are few spaces require ozone freshening that will permit the necessary capacity in a single machine of the portable type. In one application it was attempted to serve 200 girls in a candy factory with a single machine in a room with a 12-in. ceiling. It is little wonder that the proprietors could see no merit in the ozone application. In the same town, there is a large wholesale grocery office, with space housing about 80 clerks, where a single machine is satisfying the owners. But the great ceiling height with relation to floor area permits this.

OZONE MACHINES MUST BE KEPT CLEAN.

A great many ozone installations have fallen into disuse because the owners had not been instructed how to keep the machines clean. Machines must be so constructed and so located as to afford ready cleaning. The portable machines which the writer has been using are fitted with a fine wire mesh over the air intake to intercept dust. In some tile-floor banks and offices, where the floors are mopped every day, these screens must be cleaned twice weekly to keep them free of dust.

SPACING OF BRUSH POINTS.

It would seem that the production of ozone is governed by the same laws as to spacing of brush points and velocity of air flow, that apply to the convection of heat in radiators, so that the variation in wattage indicates a variation in the output of ozone.

While, as previously stated, the machines used by the writer have 600 points for the brush discharge for the ozone necessary for 1000 C. F. M., other types use 1000 brush discharge points per 1000 C. F. M. capacity, with a wattage of 10.

USE OF GLASS DI-ELECTRICS.

In the researches made by James Todd, of Pittsburgh, which were carried on under the supervision of a committee of Pittsburgh people, several of whom are trustees of the University of Pittsburgh, he found a great variation in ozone output that he could not explain for several years. Finally the trouble was solved by changing the glass elements of the ozone generators every six months.

Most ozone-equipment manufacturers use glass di-electrics. Glass, however, seems unable to stand up for any extended use under the electric stresses set up. Reports from a large government institution that uses a glass di-electric ozone machine for water purification, shows a very high replacement cost for the glass elements. Of course, water damage may be responsible for this, but until it is fully established that a glass has been produced that will give long life under the electric stresses of ozone production, those who buy equipment with glass di-electrics should appreciate that they face either a frequent replacement item or a decreased ozone output.

ECONOMY AND WASTE IN WARMING BUILDINGS INTERMITTENTLY USED

BY S. HOMER WOODBRIDGE

THE thermal function of housing, of clothing and of air conditioning as to temperature and humidification is the regulation of the rate of heat loss from the body. The process of elimination is complex in method and subject to a wide range of variations in each of the several methods. The matter can be considered here only in such general terms as are adapted to the specific purpose of the present discussion.

In general, it may be noted that of the three major methods of heat elimination; convection, radiation and evaporation, evaporation is the more widely variable and the more automatic in variability. The rate of body-heat production is largely dependent on the rate of body-work. In case of hard work that rate for the same body may be treble that normal in a state of repose. The atmospheric conditions remaining constant, the heat-elimination rate by C (convection) is changed only by change in clothing, and by the increase of body motion within the air incident to the greater body activity and movement.

The rate of heat loss by R (radiation) would be, in general, less changed by increased activity than that of C. When the increases in C and R do not equal the thermal increment, the burden of excess elimination falls on E. The skin tingles with the cumulative sensation of heat, the pores open, and the more rapidly circulating blood brings its excess of water to the cuticle surface, which passes through the open pores, wetting the outer surface to supersaturation. Evaporation is thus increased because, first, of the aqueous quantity furnished for the process, and, second, because of the effect of increase in motion through the ambient air. Meanwhile breathing becomes more full and rapid, and evaporation from the lungs and other internal surfaces is correspondingly increased.

For the purpose of present study, let a case be assumed in which the state of clothing, of air condition, of surrounding surface temperatures and of body repose are such as to make the rate of heat elimination by C 140 B. T. U. per hour, by R, 120, and by E, 90. Let the average temperature of the body and clothing surface be 90° F., that of the ambient air 70°, and that of surrounding surfaces, 58°, the last temperature named being due to chilled walls and windows in winter season. Thus

$$C + R + E = \text{Total}$$
$$140 + 120 + 90 = 350.$$

THERMAL COMPENSATIONS.

Manifestly, any change in one or more of these factors must result in an equalizing change in the remaining factors, or factor, if the total rate of elimination is to remain constant. Let the state of repose be unchanged, and the rate of elimination by E be correspondingly constant. The situation as stated makes the rate per hour of heat loss by C per degree of temperature difference between the air and the body 7 B. T. U. Likewise, the heat-elimination by R is found to be 3.75 B. T. U. per degree of difference between the temperature of body and wall surfaces. Because C + R = 260, it becomes a simple algebraic process to compute the data for the construction of the accompanying graphical table, which shows compensating temperature conditions, in abscissa air temperatures and in ordinate surface temperatures. For any point on the line A B there may be found the corresponding air and surfaces temperatures which in unison effect a thermal elimination of 260 B. T. U. from the normal body unchanged as to clothing and state of exercise.

APPLYING TABLE TO HEATING WORK.

From this table may be found any temperature of air or of surface which will compensate any change in temperature of surfaces or air within the range of the table, other conditions affecting the rate of heat elimination remaining constant. If, for instance, the average thermal effect of wall temperatures changes from 58° to 85°, the rate of heat loss from the body by R is so reduced as to demand a higher and compensating rate by C, which must be increased to an extent represented by a drop in air temperature to 55.5°, as shown by the table.

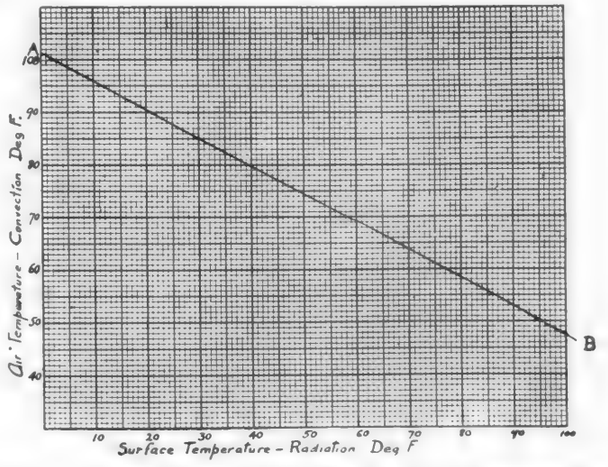


FIG. 1—GRAPHIC CHART OF COMPENSATING TEMPERATURE CONDITIONS.

This law of compensation is one of vital, yet too generally unrecognized, moment in problems involved in the warming and ventilation of some enclosures, such as audience halls.

The substantial correctness of the table has been demonstrated by experience in rooms at the Massachusetts Institute of

Technology and the United States Capitol. In the first instance, in a room, 15 by 30 ft., having brick walls on two interior sides, 15 and 30 ft., partly filled with warm air flues, one 30-ft. unwarmed wall and, one 15-ft. exterior wall, one half window, double glazed, an air temperature of 53° was found to be as comfortable as 68° in an adjoining room without warmed walls. A certain senator insisted on an early-day warming of the walls of his room at the Capitol by filling it with superheated air, so that on his arrival by mid-morning he might be able to sit comfortably at his desk in air kept cool by air indraft through an open window. A like practice obtains in certain opera houses frequented by many in such "full-dress" that compensation for excessive heat loss by C must be had by superwarmed surfaces, obtained by over heating the auditorium for some hours prior to use.

WHY COOL JUNE DAYS ARE COMFORTABLE.

The table furnishes an explanation of the comfortableness of June conditions within a room in which the air temperature is 60° (intolerable in winter, when walls are cold), because the surfaces of walls and windows are warmer than in the winter season, and particularly so if the cool wave, of short duration, be preceded by one which has warmed the walls and contents of rooms. The higher temperature of surfaces compensates for the lower temperature of the air.

The method of compensation for excess of loss by C by reducing the rate loss by R is one to be recommended on hygienic, rather than economic grounds. The cooler the air in which the body may maintain its normal thermal state and feeling, the more invigorating the air quality, and the greater the vital energy. But the warming of buildings is far more costly than a corresponding warming of the air they contain.

AIR HEATING VERSUS BUILDING HEATING.

The superheating of a building and the compensating sub-heating of the contained air is advantageous hygienically rather than economically, and, conversely, a sub-temperature in walls and a super-temperature of contained air is advantageous financially rather than hygienically. But hygienic effects are to be measured in good part by the duration of exposure to conditions affecting health. The longer the period the more pronounced and prolonged the hygienic effects. Per contra, the shorter the period, the less in severity and duration are those effects. The residence may be continuously occupied; the school house one fourth of the time, the church and the lecture hall one hundredth of the time. The method of warming by superheating air is not applicable to residences either hygienically or economically. In the case of school buildings it may be applied to preliminary warming only. To churches and halls the method may be applied for both initial warming and also for the short sessions of use common in such edifices.

In the case of an auditorium infrequently used, it is common in cold climates and weathers to extend the warming-up period over a day and a half or a two-day interval, with a corresponding expense in fuel and labor costs; whereas, if the edifice had been planned and constructed with successful reference to quick warming by air rather than by building heating, the warming process could be completed in as many minutes as are required in hours to warm by the building-heating method. In the case of an auditorium of 500,000 cu. ft. air contents, the weight of the contained air is approximately 19 tons, and the specific heat of air is 0.2375. The combined weight of 2-in. thickness of walls, ceiling, floor, gallery construction and furnishings of so large a hall would exceed 500 tons, and the mean specific heat of such material may be assumed as 0.64. Therefore, to raise the temperature of that material through any range of temperature would require nearly seventy times the heat quantity expended in raising the air contents of the chamber through the same temperature range.

It is the building, rather than the air, heating which consumes both fuel and time, as well as labor. The heating equipment commonly furnished for a building of the type in question is barely sufficient to maintain an interior temperature of 65° against outside weather of 0°, a difference of 65°. Perhaps for five days the building may have lost heat under conditions of a mean temperature difference of 35°. To make that 120 hours of loss good under even 65° of temperature difference would require 65 hours, disregarding the loss taking place during those hours. Hence, the economic value of any practicable method which reduces building warming to a minimum, and which increases to a maximum the warming work by the heating of air.

WHEN SUPERHEATING OF THE AIR IS ADVISABLE.

When that ideal method is not available, that of superheating the air to compensate for the lowered temperature of walls and other interior surfaces may be employed in certain classes of buildings to economic advantage. If the surfaces within the chilled auditorium in question have a mean effective temperature of 40°, the graphical table shows that, for the assumed state of clothing, etc., the air within the auditorium to render thermal conditons comfortable should then have a temperature of 80°. Let the provisions for air rotation through the convector heater be such that 50,000 cu. ft. per minute at 40° can be taken from the auditorium chamber and passed back to it at 120°. That same fan and heating furnishment is capable in zero weather of passing the same volume of outside air through the heater warmed to 96°. That would yield to wall and other surfaces 28,000 B. T. U. per minute, which, with the animal heat yield of 10,000 B. T. U. per minute, from 2500 occupants, would maintain a comfortable thermal condition after the shift is made from rotation to inflation for both warming and ventilation. The low animal thermal output above given is due to the 26% of such heat which disappears in vapor, the heat from which is yielded only on its condensation or absorption.

HOW A CHURCH BUILDING WAS WARMED IN TWENTY MINUTES.

As examples of quickly warming by superheating air within rooms, it may suffice to cite two cases out of a considerable experience,—one of a large church "warmed to comfortableness" in the coldest of weather within twenty minutes after steam for that use is avilable; another of a sizable normal school building to which the principal came at 8:30 one—30° Monday morning to find the janitor-engineer off duty through sudden sickness, but fires started and steam ready through the service of the janitor's son, a pupil attending the school. At 9 o'clock all needed rooms were reported, as to thermal conditions, ready for use.

DESIGN OF BUILDING FOR USING A MINIMUM OF AIR AND BUILDING HEATING.

Limited space allows no more than a brief outline of a single design of building adapted to warming by a minimum of both air and building heating. In the case of the audience hall above cited by way of illustration, the 20,000 sq. ft. of wall surface, which may be of stone, brick, concrete, or other solid construction, may be covered with a curtain wall of fibre-board and plaster, or other equivalent material, erected in such manner as to provide a space of not less than 4 in. depth between the solid and the curtain walls, that space extending about the perimeter of the hall, and serving as an air passage. The same effect may be had by the use of open tile blocks of suitable pattern.

Both top and bottom of that inter-wall air-way open free, the top into the auditorium chamber at the ceiling level, and the bottom into the sub-chamber beneath the auditorium.

From the sub-chamber is a large out-board vent shaft extending above ridge level, and provided with a damper at the top. Within the sub-chamber is an air heater and fan of capacities above indicated, the delivery from fan being connected through sheet-metal pipe ways with apertures through the auditorium floor for giving diffuse and even flow of air into that chamber

The air intake to the heater is connected with outside air, and so dampered that outside air may be excluded and sub-basement

air substituted, or that, by damper adjustment, the two airs may be mixed in any proportion desired.

For preliminary warming of the auditorium, the out-board flue damper is closed, the air intake damper is thrown to exclude outside air and to draw in sub-chamber air, the fan then exhausting air from the sub-basement, and passing it rewarmed into the auditorium, the air in circuit passing down through the inner wall air-way from the upper to the lower chamber. The curtain wall and inter-wall air-way are then economically effective in three ways; first, in preventing contact of auditorium air with the outer solid and cold walls, to chill that air and produce troublesome down drafts of cold air; and second, to quickly produce a warmed curtain wall, so reducing the temperature of ambient air otherwise required to compensate for excess of radiation to walls; and, third, the whole shortening the time required for the preliminary warming process, and reducing both the amount of building heating and the temperature of air supplied to the auditorium both for preliminary warming and for occupancy.

The method here described is chiefly applicable to that class of buildings to which this paper relates, viz.: those designed for intermittent use. In the case of buildings continuously used and in which habitable warmth is as continuously maintained, building warming is unescapable to an extent much greater than may be made possible in those intermittently used and planned for warming by a maximum of air and a minimum of building heating.

INSTRUCTION COURSE FOR CUSTODIANS AND JANITORS

Lesson No. 8—Hot Water Supply

BY EDWIN S. HALLETT

Chief Engineer, St. Louis Board of Education.

A PERFECT hot water supply for schools and public buildings is not often found and some good advice should be given the designers of this kind of equipment. The custodian should know wherein his troubles originate, in order to recommend improvements. For a supply of warm water for lavatory use the simplest and cheapest is a 40 or 50-gal. tank, with a steam coil within it and the temperature of the water controlled by one of a number of good regulators. The proper temperature of lavatory water is about 140°. Temperature higher than that will check the enamel on the vitreous ware.

In buildings of considerable size larger tanks should be used and the coils be so inserted within the storage tank that they may be easily removed for cleaning. The coils will not run very long in most cities until they are choked with scale. The convenience for cleaning should be a determining factor in the selection of the heater.

Where shower baths are used in considerable numbers, as in some schools, it is necessary to provide two heaters, set at different temperatures. The showers should have water of not to exceed 100° and it is not safe to depend upon a mixing valve or a non-scalding valve, nor upon an attendant. The manufacturers of these valves may disagree with this and may demonstrate their valves to perfect satisfaction but after a child has been scalded with it it is too late to correct the damage. "Safety first" rules govern here.

USE OF PIPE COILS IN STEAM BOILERS.

Many other devices may be used for heating water. A good one is a pipe coil of relatively small size placed within a steam boiler. The cold water passes through this coil and thence into a tank of suitable size and a circulating pipe connected back to prevent the accumulation of steam in the pipes when little water is being used. For some purposes this is an excellent hot water supply. It does not admit of good temperature control. In large buildings having an intermittent demand for hot water a complete hot water circulating system must be installed. It would be a waste of water and a trial of patience to let the water run until hot water came from the basement every time the lavatory was used.

HOW TO DEAL WITH SCALE IN PIPES.

The problems of the circulation of hot water is in the rapid incrustation of the pipes with scale. It is unfortunately true that the pipes must be taken down and renewed or cleaned after a few years of service in most cities. The use of a large precipitating tank after the heater will greatly lessen this trouble. The use of brass pipe is of small value in preventing scale formation.

The use of a small pump for circulating hot water is generally necessary although good gravity circulation can be installed. A convenient means should be provided for starting the circulation or reversing it when occasion requires. Air valves must be installed at the high points of all the risers and at the heater.

In plants that require hot water all the year and the steam from the heating boiler is not available in summer some other economical means must be provided. In some plants enough waste paper and other combustible waste is on hand to heat the water. Such plants should install a small steam heater connected to the regular steam coils or heater so that the general system may not be disturbed.

POINTS ON CLEANING TUBULAR HEATERS.

All tubular heaters must be cleaned of scale and other deposits as the temperature of the water will drop and nothing will correct it but cleaning. Smooth straight tubes are easily cleaned by making a cleaner of a piece of pipe with a sharp or saw tooth cutting edge to be rammed through the tubes. The bent "U" tubes are difficult to clean even when out. Beating lightly with a wooden club loosens the scale which may be hooked out. Spiral tubes and corrugated tubes must be removed and replaced. Many heaters have the expansion through packed ends and these must be repacked at intervals. All heaters with perfectly straight tubes rolled rigidly into a head develop leaks very early because there is no provision for unequal expansion. Brass and copper tubes have always been popular because it was thought they resisted corrosion better than iron, but the weak part of heaters is not corrosion but the two demons of scale incrustation and unequal expansion.

NECESSITY OF TEMPERATURE REGULATION.

The temperature regulation may be an integral part of the house temperature regulation if no hot water is required when the heating plant is shut down. Otherwise the tank should have something on the order of the sylphon tank regulator which has a volatile liquid in a tube within the

heater which volatilizes to produce a pressure on the sylphon bellows of the steam valve. This is highly desirable where the residual steam of a banked boiler maintains heat after hours.

Hot water for hotel kitchens and laundries must be up to near the boiling point and can not be taken from the ordinary domestic supply. It would be better not to attempt to make one heater do for both purposes. The small cost of a separate tank is too small to justify the risk of scalding and complaint of users of the lavatories.

KIND OF PIPING TO USE.

Do not use black pipe for hot water as it will color the water with rust. Use galvanized iron, brass or lead pipes. Cast-iron was once largely used. When lead pipe begins to leak a plumber should be called to wipe a new joint. There are places where such a mechanic can not readily be found. In such emergency the lead pipe may be cut and the ends joined with a cast-iron union of a size to pass the pipe through the threaded ends and flange the lead pipe ends over the faces of the union. Brass pipe is not elastic like iron and a fitting will always leak if backed off in the least. Provision must always be made for expansion and contraction of pipe lines and never make a rigid fastening nor take off a branch without providing for movement of the pipe.

Hot water can not be lifted very high on the suction side of the pump and such pumps should be installed so that the water may flow to the suction. Cold water should always be piped to hot water pumps for chilling steam when they stop from that cause.

Questions

1. What is the simplest hot water supply?
2. What is the best kind of steam coil for water heater?
3. When should two heaters be used?
4. What is proper temperature for lavatory water?
5. What is the objection to mixing valves for varying the water temperature?
6. How may hot water be maintained at distant points from the plant?
7. Why do hot water pipes fill with scale matter?
8. Why are air valves necessary on hot water lines?
9. What are the advantages of gas for fuel? What precaution is necessary?
10. How are heater tubes cleaned?
11. How is the temperature of hot water regulated?
12. Formulate a set of rules for the janitor on the hot water service.

FUEL SITUATION IN NEW YORK CITY

BY JOSEPH M. LONERGAN

Supervising Chief Inspector, New York City Department of Health.

THE winter of 1920-21 was one of great moment for the City of New York in particular reference to its coal supply. Depending on an anthracite fuel, its scarcity and exceedingly high price found many property owners investigating the possibility of using bituminous coal.

The Department of Health was requested to lift the ban upon the use of soft coal. To the apparent surprise of these petitioners came the answer from the department that there was no prohibiton against the use of any fuel, the condition of such use requiring that no dense smoke would be discharged thereby.

The newspapers published this statement and soon we found that office buildings, hotels, apartment houses and a considerable number of factories were turning to the use of soft coal.

It is an accepted fact that the use of bituminous coal offers a more readily variable factor in steam control than does anthracite coal. Consequently it is replacing the hard coal in factories and, from the manufacturers' standpoint, giving excellent satisfaction. It is safe to say that, at the present day, over five million tons of soft coal are used in this city annually.

New York City does not welcome the change in its fuel from anthracite to bituminous coal. The resulting pollution of the air of the city is too apt to increase the morbidity and mortality rates, to decrease the amount of sunlight and increase the fogs in the city, to cause a large property damage through its deposits. But, notwithstanding these possibilities, there is a gradual change over the fuel supply of the city. Considering the increasing price of anthracite, the greater difficulty in obtaining it, brings a realization that our city, like so many others, will be compelled to resort to the use of soft coal.

The amount of coft coal consumed in New York is considerably more than is generally believed, in view of the lack of any great volume of dense smoke noticeable. The courts realize the advance made in smoke elimination and no longer deal leniently with persons violating the Sanitary Code (Section 211) by permitting the discharge of dense smoke. And this is as it should be. We know that a furnace properly constructed, maintained and operated, with an adequate draft, a chimney stack of suitable proportions with no air leakage, in the care of competent men, is capable of burning bituminous coal without smoke nuisance.

The trouble in the past has been that the furnaces were constructed for the burning of anthracite coal. The change over to bituminous coal cannot be made without changing the furnace construction, increasing the combustion space, etc. A failure to make such changes has resulted in trouble.

There is another fuel which is attracting considerable attention in and around New York City. It is fuel oil. While there are several stationary plants using this fuel the greatest advance in its use has been made in the instance of liners entering this port. The more ready handling of oil, the reduction of force for its use, and the general cleanliness around the plant as a result of its substitution are apparent.

The maintenance of a proper temperature of the oil, of suitable pressure at the burner and provision of an adequate air supply readily prevents a dense smoke discharge.

Briquets and coke were used extensively during the last winter but were not entirely satisfactory. In the instance of coke this might be corrected to a great extent by the substitution of deep grates in domestic furnaces for the present shallow coal space.

For the burning of bituminous coal in apartment houses recourse has been had to the down-draft type of furnace. Where these are given a reasonable degree of care, excellent results are obtained without nuisance.

The Heating and Ventilating Magazine
A MONTHLY JOURNAL of ENGINEERING PROGRESS
Member of the Associated Business Papers Inc.
Member Audit Bureau of Circulations.

Vol. 18 September 1921 No. 9

Published Monthly at Cooperstown, New York, by the
HEATING AND VENTILATING MAGAZINE COMPANY
Executive and Editorial Offices
1123 BROADWAY, NEW YORK
A. S. ARMAGNAC . . . . . President and Editor
GUSTAVE PETERSEN, Secretary-Treasurer and Business Manager

European Representative
W. G. HOLLINGWORTH, Bessemer House, Adelphi, London, W. C.

Subscription	$2.00 per year
Canada	2.25 per year
Foreign Countries	2.50 per year
Back numbers	25 cents each

A REFERENCE to former house-heating boiler catalogues, which was found necessary in the preparation of one of the leading articles in this issue, discloses to a striking degree the great changes in boiler design that have taken place during so comparatively short a period as the last 25 years. The trade of that time (in the middle 90's) no doubt felt that the art of boiler construction was well advanced, and glowing descriptions are to be found in that period of the achievements wrought, especially in the matter of design. The various types then on the market seemed to be firmly established as staple merchandise, like horse-shoes, nails or padlocks.

And yet today the catalogues of 1895 (which are the ones at hand) look like ancient history, no less in regard to the designs presented than in the quaint and stereotyped manner of presenting their features. One can count almost on the fingers of one hand the boilers then in vogue which still survive..

When it takes an old-timer to recall the standard types of less than a generation ago, it makes one wonder what the next generation will think of the boilers of to-day.

PERHAPS at no time in the history of boiler-making has the development been so rapid as it is at present. As an evidence of this, no less than three prominent manufacturers of boilers, during the past year, have announced radical changes in their smokeless boiler designs from down to up-draft. This, in fact, may be considered as the dominating issue just now in the boiler field, and the statements pro and con to be found in this number show to what an extent the subject is still in the argumentative stage.

In this connection it begins to look as if some other terms than "down-draft" and "up-draft" will have to be coined, since some of the so-called down-draft types, like the magazine-feed, differ materially from the commonly-accepted notions of what constitutes down-draft operation. One correspondent suggests the power boiler term of "straight-draft," instead of up-draft and this, we believe, more properly characterizes the principle of combustion of a magazine-feed "smokeless" boiler. At any rate, the smokeless boiler, simply unheard of in the "old" days of 1895, has achieved a position at the forefront of modern house-heating boiler practice and the end is not yet.

A POINT raised by one of our contributors over the advisability of publishing matter containing very frank comments on the attitude of some engineers towards the newer methods and appliances in the heating field, gives us the opportunity of presenting both viewpoints, in the hope that they may serve to clear the atmosphere for others who may have wondered at the self-imposed limitations of editorial expression. The point at issue was whether the responsibility for invidious comments of any sort lay entirely with the author or was not borne in part by the journal publishing the comments; also the further question as to whether an unwillingness to publish such matter which, even though true, might hurt or at least offend large bodies of readers, indicated an attitude of ultra-conservatism, or, as it was characterized, one "typically eastern." "I have been accustomed to express my thoughts and convictions in my own way," was the argument, "taking full responsibility for what I have to say. Those who do not agree with me have the same freedom in expressing themselves as they choose." Is it not true, however, that while a journal is, perhaps, not responsible for every statement made in its columns, it is, nevertheless, held to account for permitting such statements to appear.

When it comes to the question of conservatism, experience has demonstrated that the general run of writers on engineering topics may be divided roughly into two groups. In one group are those whose measured statements of opinion and carefully-expressed facts are so reasonable and convincing as to carry great weight. In the other group are those who may write with equal authority, but whose expressions are often only thinly-veiled abuse of those who differ from them. We believe that the man who commands the most attention and respect in the engineering field is the one who expresses his thoughts in a purely dispassionate manner, without indulging in any feeling or personalities. The minute a man goes out of his way to take a fling at someone or something on no stronger ground than his own personal opinion, he is very quickly classed as a breezy writer, but a doubtful leader. The average reader wants to see such a man's judgment supported by someone with more poise.

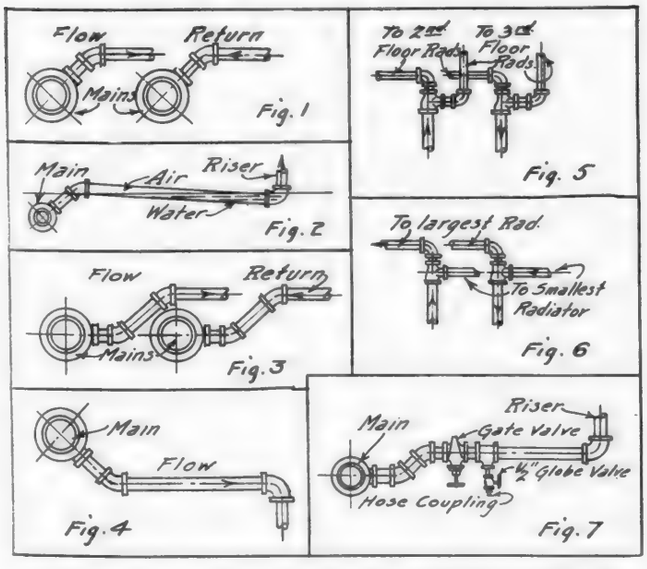
WRINKLES

Piping Connections For Air Venting and Uniform Circulation In Water Heating Systems.

While water is a good conveyor of heat, it is a poor conductor of the same, since the molecules of water do not quickly give up heat to one another, but require a continuous circulation and mixture. Thus, circulation in a water heating system becomes of utmost importance, since hot water only at the heater is of no particular use if it cannot circulate to the cooling or radiating surfaces.

Rapidity of circulation will mean a higher average temperature maintained in the radiating surfaces, smaller pipe sizes from increased rate of transmission and reduced losses in transmission because of the smaller pipe sizes. But is also important that the circulation be uniform and this requires a system proportioned throughout as to sizes of mains and branches, so that each radiator receives the proper amount of circulating water without robbing some other radiator, near or distant.

Taking all branches from the top (Fig. 1) where the hottest water runs results in short circuiting, the first radiators getting all the hottest water. Nor should branches be taken from branches unless the conditions are exceptional. Better control is obtained by going back to the main for each group



PIPING CONNECTIONS IN WATER HEATING SYSTEMS

of radiators so that the piping system is balanced by each main supply serving equal amounts of radiation.

First-floor radiators should be favored by individual connections from the mains and, in general, the sizes of long mains should not be reduced since this will offset the disadvantage from friction and cooling due to distance from the heater. It will also secure a high velocity and even distribution of the water throughout the system since frequent reductions are the cause of sluggishness and short circuiting.

Provision should be made for eliminating the air from the systems because a radiator or pipe that is air-bound is dead as water will not circulate through any part of the system thus hampered. A pipe trapped or pitched the wrong direction (Fig. 2) a height equal to its own diameter will allow a collection of air that will shut off circulation. Thus, a large pipe if not properly vented is of no greater efficiency than a smaller one.

The connections shown in Fig. 3, while useful in restricting circulation to first-floor radiators near the heater and to risers for upper floors, should not be used where a reduction in size of main occurs. In such cases, the connections shown in Fig. 1 are necessary in order to vent the main at the point of reduction. Such connections (Fig. 1) are also required for first-floor radiators located at some distance from the heater.

The connection shown in Fig. 4 is used only for radiators which do not require venting, as in down-feed systems, or basement radiation where the radiators are located below the main; the air being vented from upper radiators, or, if this be down-feed, from the high point of the system.

Fig. 5 shows radiator connections from risers, the importance of which are generally realized since hot water tends to rise more readily to upper floors and also to take the path of least resistance. As shown, the second floor radiator is favored by being connected from the top of the tee, but the otherwise more active flow to the third-floor radiator is restricted by the riser connecting from the side.

Two radiators of unequal size when located on the same level and connected to the same riser should be supplied as shown in Fig. 6, the larger radiator being connected from the top of the tee. This method favors the radiator to which the circulation should be more active since a greater volume of water is required to supply heat for the larger radiator.

In some cases, runouts to radiators or branch arms to risers, are each provided with a gate valve looking down as shown in Fig. 7. A globe valve and hose connection is also installed in order that the water may be drawn off from the piping, as required for repairs, or to prevent freezing when not in use.

Increasing the Circulation in Gravity Water Heating Systems by Replacing Elbows with Offsets.

The friction interposed by valves and elbows and other fittings to the passage of water is a subject on which there appears to be little available data of value though fortunately it is unnecessary in ordinary heating work to compute the loss of head due to their resistance. However, the friction is comparatively much higher in the smaller sizes of fittings,

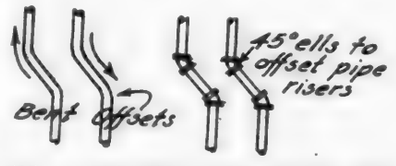


FIG. 1.—METHOD OF REDUCING FRICTION BY REPLACING ELLS WITH OFFSETS.

so that in some cases it may be found advantageous to limit the use of elbows by bending the smaller sizes of piping where offsets are required (Fig. 1), particularly where the motive power or head is somewhat limited, as often occurs in gravity water heating systems.

In the smaller sizes of fittings, say from 1½ to 4 in., the radius of the center line of the elbow is roughly 1¼ times the diameter of pipe for standard elbows; 1¼ times the

diameter of pipe for long turn patterns and 2½ for extra long-turn elbows. The relative resistance, or loss of head is as follows: Standard, 100; long turn, 83 and extra long, 77. While these figures may be considered merely approximate, they serve to show in a general way the great advantage of long-turn elbows over those of standard short-body patterns for water heating.

Lift Fittings Make It Possible to Install Radiators and Piping Below the Returns of Vacuum Systems.

In vacuum return systems it is possible, but not always practical, to install radiators and piping somewhat lower than the returns, providing lift fittings are used; since such fittings insure the lifting of the returns to the higher level because of the always present well of water, the water being lifted from the well as fast as it is received.

The return pipe also may meet with various obstructions which it must get over, around or under, such as underground water mains, a beam or doorway. This and problems of a similar nature though quite frequently encountered in the design of vacuum systems may be overcome by means of lift connections, as shown in the accompanying illustrations.

While such connections may be readily made up with pipe and regular fittings, somewhat as illustrated in the "Dunham Hand Book," this particular advantage of a vacuum system should be used sparingly, or only when absolutely necessary, since it is not always advisable to do what is possible.

As shown in Fig. 1, the lift is provided with a lift pocket "B," 8 in. deep and two sizes larger than the return main "A," and a lift pipe "C," one and one-half the diameter of return main. This lift pipe to operate properly must be extended 4 in. (and no more) below the bottom of the return main and not over 6 ft. above the top of this main. If the lift "D" is higher than 6 ft., the connection should be repeated in step formation for each 6 ft. of height. A ¾-in. gate valve and hose nipple for draw-off should be provided at "E" and two short nipples at "F." The loop shown in the piping at this point is for the purpose of preventing the water from falling back as it is lifted.

Fig. 2 shows the lift connection and position of trap when a radiator is below the return main. In this case the trap must be at the high point or above the lift, as illustrated. The lift connection, of course, should always be carried above the pipe into which it discharges.

While it is preferable to install a vacuum pump with return piping so that the return will always be above the suction inlet of pump, should necessity bring the return below the pump suction, a lift pocket must be provided and the connections made as illustrated in Fig. 3.

Under emergency conditions a vacuum system can circulate without lifts, but when these are present, the vacuum pump must be continually in operation or circulation is stopped. It is claimed that 16-ft. lifts have been used with success, but, generally speaking, the necessity for a high lift is rather a remote contingency; something which may usually be avoided in a system properly designed.

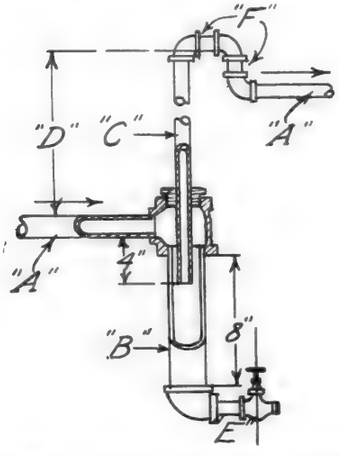


FIG. 1.—TYPICAL LIFT CONNECTION IN VACUUM RETURN MAINS.

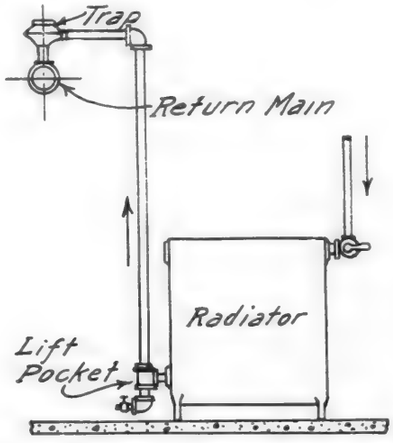


FIG. 2.—ARRANGEMENT OF LIFT CONNECTION WHEN RADIATOR IS BELOW MAIN LEVEL.

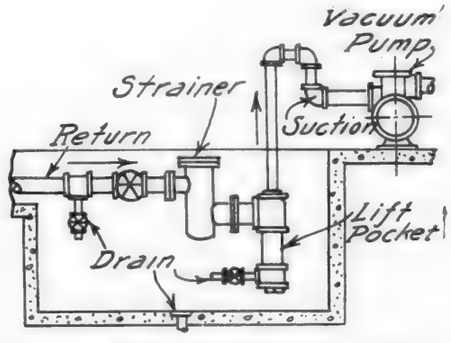


FIG. 3.—APPLICATION OF LIFT CONNECTION TO SUCTION INLET BELOW VACUUM PUMP.

Some Common Faults of Chimney Construction Remedied by Simple Stack Extension.

No matter how complete or well designed the heating boiler and system may be, the chimney must still be relied upon to furnish sufficient air for proper combustion. Thus, a chimney is often built with its top lower than the main part of the building or some building near it, so that the wind blowing over the higher building comes like a waterfall directly down the chimney to beat down the smoke and kill the draft. The remedy is to build up the chimney, or add a smoke stack to a height above the main building, or other building nearby.

Stack extensions, made as shown in Fig.1, completely cover the top of the chimney and do not fit into the inside of the flue opening so as to cut down the effective flue area. The base is fitted well down to chimney ledge while the diameter of round

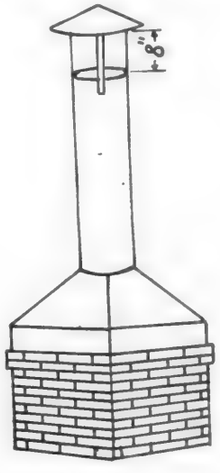


FIG. 1.—STACK EXTENSION TO IMPROVE DRAFT.

part of stack is made equal to the chimney flue. It will also be noted that the cap at the top of the stack is placed well up from the stack outlet.

In Fig. 2 the flue from the center building ends in a pocket between the upper extensions of two buildings. A high stack is necessary here to create a draft, or if the adjacent building is very high, the stack should be off-set as shown in dotted.

Fig. 3 illustrates a condition where a chimney flue starts near

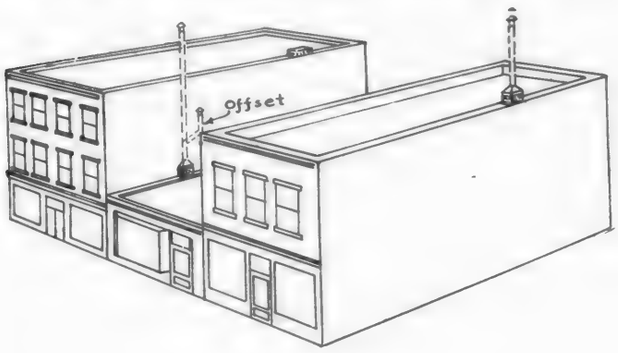


FIG. 2
CASES REQUIRING STACK ERTENSION.

FIG. 3

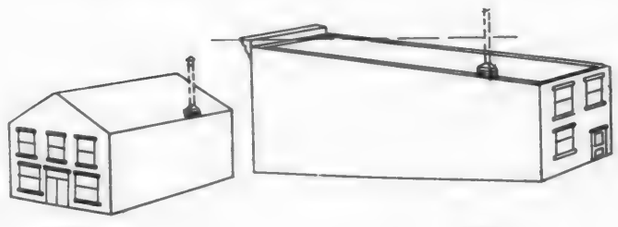


FIG. 4 FIG. 5

the roof, the remedy being a high stack to create a draft. In Fig. 4 the ridge of the roof is a great deal higher than the chimney, and in Fig. 5 the front of the roof is higher than the top of the chimney. The difficulties may be overcome in all of these cases by the use of a simple stack extension of galvanized iron.

How to Prevent Hot Water from Short-Circuiting in Pipe Coils.

The proper manner of making hot water connection to radiating surfaces, though usually detailed in the works of various authors, is nevertheless a problem to which extended reference might easily be made and still leave much to be said. It is also a fact that while the various methods have served to distribute hot water equally among the radiators or pipe coils of a heating system, they have not always caused the circulation to be the same in each pipe of a pipe coil. Thus, no matter how efficient such methods may be, so far as causing an equal flow to radiating surfaces, they but seldom prevent the lower pipes of a pipe coil from becoming too cold though the upper ones may be as hot as desired.

To overcome this difficulty, the double pipe connection shown in Fig. 1 is quite frequently used, but it is not always successful and, for this reason, it is better to use some other method, such as contracting the pipes at their inlets to supply headers. Only the upper pipes need be contracted, or each pipe may be contracted to a different degree according to its position in the coil, so that only its proportionate share of hot water will be received and no more.

Contracted pipe inlets have also been used to restrict the more active circulation to first-floor radiators near the heater and num-

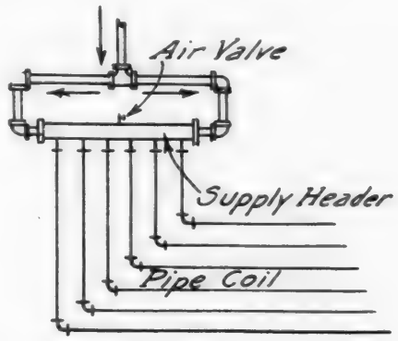


FIG. 1.—DOUBLE CONNECTION FOR EQUAL DISTRIBUTION TO EACH PIPE OF A HEATING COIL.

erous other types of connections are commonly used for this purpose, but in general, it is best to give the most attention to the returns, since these are more often the cause of trouble. This is because each radiating surface discharges cold water at different temperatures into the main return, thus slowing up the circulation from some other radiator. To prevent this, a good rule to follow in most cases is to use two separate supply branches to each three radiators or pipe coils, as the case may be, and three separate returns from these radiators directly back

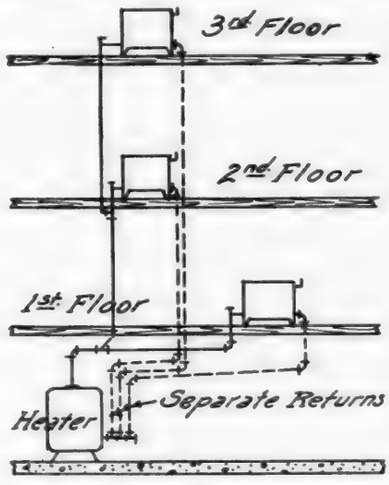


FIG. 2.—CONTROLLING THE FLOW TO WATER RADIATORS BY MEANS OF SEPARATE RETURNS.

to the horizontal return header at the heater, somewhat as illustrated in Fig. 2.

Lock-shield valves are often used for throttling and providing individual control at the return of each radiator, but in large installations they are sometimes tampered with by different steam fitters, so that in the course of time all advantage of control is lost unless readjustments of the entire system are made. They are usually drilled so that, with the radiator valved off, a certain amount of circulation still takes place to prevent freezing, but quite often when valved off, in particular with forced water heating, the circulation is too pronounced and the radiator continues to give off much more heat than desired.

Probably the best and only positive method for equal circulation in all pipes of a pipe coil is to use the series or return-bend type of coil, since the water must then follow the only path which is provided.

Preventing Freezing Troubles in Intermittently Heated Buildings.

One of the most annoying difficulties on intermittently heated buildings, such as churches that remain cold from one week end to another, or schools that are left without heat, from Friday night until Monday mornings, is the freezing of the radiators. The trouble is not limited to two pipe work, either.

In many school auditoriums, heated by excellent one-pipe steam work, such troubles have burst so many radiator sections, that the radiator surface is now less than half of that originally installed.

The trouble is, of course, more common to two-pipe work, and particularly to vapor work, where carelessness often leaves supply valves partly or entirely closed. This admits just enough steam to the radiators to make enough condensation for freezing troubles, without admitting enough heat to prevent them.

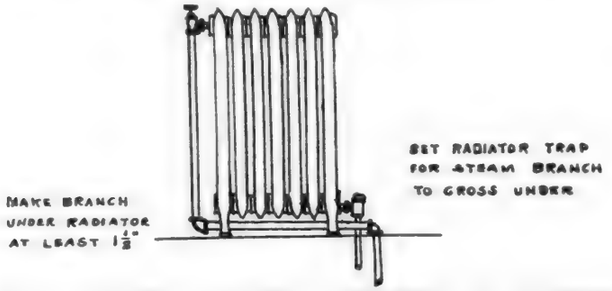


FIG. 1.—TWO-PIPE RADIATOR CONNECTION TO PREVENT FREEZING.

No system of heating that uses steam, is free from such troubles. While they can and do occur when warming up plants in freezing weather, if proper precautions are not observed such difficulties most often occur when, on a banked fire, the premises are cooling down. Very often, there is only just sufficient freezing to close off the return of the radiator, to make trouble for the unwary janitor when he next fires up.

Of course the real prevention is the drilling of janitors and attendants until they understand that on a banked fire, the mains must be shut off and drained. And that, when warming up a building, with freezing temperatures in it, enough attention must be given to fires to push them continuously to the limit, until

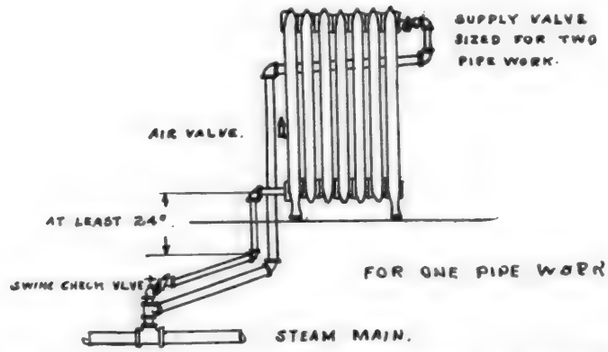


FIG. 2.—ONE-PIPE RADIATOR CONNECTIONS TO PREVENT FREEZING.

sufficient steam has been raised, to heat the radiators through.

Those who practice in cities have little comprehension of the enormous amount of such troubles that those who install heating in country buildings face.

Vestibule radiators, on steadily heated work, under the best of attention, often give the same difficulty. It has been found that arranging the radiator connections as indicated will make the heating plant just that much more fool proof. It will be apparent that the arrangement of connections insures a free drainage of the radiator as long as any vapor can pass into it, as well as the thawing of the return if it should freeze, before any further condensation can be put into it. This precaution is of especial importance on any work relying on automatic devices on the radiator return outlets.

Such devices, under certain conditions, frequently hold condensation in the radiators under circumstances that will permit frost to close the passage through the mechanism, to make trouble for the janitor unless he is observing enough to thaw the devices before the next heating period.

CHATS WITH UNCLE BEN

Automatic Temperature Regulation.

"I LIKE automatic temperature regulation" said Uncle Ben, "but it makes me tired and sore to see people abuse it. After all, automatic temperature regulation as we apply it to heating systems, is nothing more than a device which shuts off the heat when the room gets too warm and which turns it on again when the room, owing to outside chill, cools down."

"How about ventilating or air conditioning systems," I asked, doesn't automatic temperature regulation do more then?"

"Well, hardly," said he, "for a ventilating system is simply a little more rapid in its reactions to outside temperatures, and I don't see that the basic principle changes. The heating system builds up, the outside temperature pulls down, and the automatic temperature regulating apparatus helps hold the heating system within reasonable limits in mild weather."

"What stirred you up about abuse, Uncle Ben?"

"Repeated experiences in high up-and-down theatres,' said he. "I mean theatres or picture houses where there are several balconies, or where there are considerable differences in level within the same room.

"In these, particularly those with refrigerating apparatus for summer cooling, I have found many of the patrons moving higher or lower, seeking a temperature zone that would be comfortable. The cooler heavier air settles to the low points, and the warmer lighter air rises to the high points.

"The owner generally has an elaborate thermostatic control, which operates in most cases like this:

> Winter or summer, prior to the arrival of the crowd of people, if the outside walls are well insulated, a fairly even temperature will be secured, whether with upward ventilation or with downward ventilation, and the thermostats will cause the air to be admitted, finally, at a temperature very close to that existing in the room, just enough warmer or cooler to balance the transmission through the structure.

"Then the crowd comes and the heat of the crowd causes the general room temperature to rise very rapidly. The warmer the room gets, the colder does the entering air stream become, as the well-intentioned thermostats know no better. The cooler the entering air, the more rapidly it falls to the lower parts of the room, and the less effective it becomes to alleviate the condition of the people in the higher parts of the rooms. The longer such a condition persists, and the colder the outside air or the greater the capacity of the refrigerating plant, the more trouble and complaints inevitably must follow. It is not easy, but always very difficult, in fact, to make air streams of greatly different temperatures mix quickly into a happy medium. For this reason, you may know, the frequent widely heralded systems of ventilation which are going to revolutionize the housing problem' by squirting outside air into the ceiling spaces of rooms 'where the hot air naturally collects' invariably fail.

"A few old timers like your Uncle Ben believe that it really isn't so terribly important after all *from what direction* air currents come; downward, or upward, or sideward, so long as there are currents, and so long as they shall not be so different in temperature from that of the air they blow away as to cause discomfort.

"So, helping out old friend Automatic Temperature Regulation, I want to give him a rational task—and to defend him from unjust criticism.

"I have learned in all my ventilating problems, where I had to ventilate people, that they would endure an air current of fairly good speed, provided it wasn't more than about ten degrees at the most, different from the general air temperature around them. They would endure more in their faces or from below than they would on their backs or from above.

"I have learned, for lofty auditoriums, that we ought to be able to deliver air at one temperature, say for the orchestra level, while at the same time delivering air at a different temperature for the first balcony, and at a temperature still different for the second balcony.

"I have learned that we should be able to deliver air not only at different temperatures for these various levels, but also that we should be able to vary the volume delivered to each vertical department, as the audience may vary, it being decidedly uneconomical to cool with expensive refrigerated air, for instance, an unoccupied balcony, and most embarrassing to spill on the heads of the patrons below, the cool air from this balcony, which under normal occupancy, of course, wouldn't spill at all, but would be neutralized by the heat from the balcony patrons.

"Don't run off bored, my boy, but bear with me just a minute more—I don't see how we could get along without automatic regulation of ventilating air temperatures, but I want you to see how unjust and unfair it is of any one to ask any automatic device, unaided, to solve the problems I have been suggesting.

"My next theatre is going to have separate mixing dampers for each vertical subdivision, and pneumatic control of volume dampers in the air-ways so that I can shut off arbitrarily in the supply and exhaust to any department from a central control. In this room there will be long-distance thermometers which will show the temperatures of the room at the various levels, and of the air delivery at each general distributing point. Not matter how hot it may get, the operating man is going to be instructed never to let the air enter more than an arbitrary amount cooler than that temperature, and I think it is going to be rendered impossible for him to get any air delivered to any point in the room much different in temperature than that which just preceded it. In other words, starting with 65°, say, with the air entering at 65°.

"The heat of the crowd, and the heat from the lights will raise the temperature, and the thermostats will cause the entering air to be reduced gradually to say 60° by the time the room temperature shall have reached 70°. If the heat of lights and crowd, despite the cool entering air, shall increase the room temperature still further, I say you must raise the temperature of the entering air proportionately, even if, as the evening wears along, the room temperature gets to 90° or more. If you permit the automatic temperature regulating system to hold the entering air down to 60° when the temperature around the people is 90°, they'll be hunting for you with a rope, and I would not blame them.

"To make this last point more clear, let me illustrate from your body. Your lungs are bags at the bottom end of a good sized pipe. They draw in a small amount of air when your chest muscles drag the bags open. The air that enters the lungs at any respiration is largely that which was in the wind pipe, since the capacity of the pipe is very great in proportion to the capacity of the lungs. When the chest muscles force the lung bags together and expel the air, a large part of it stays in the wind pipe, to be re-inhaled next time. Thus, the air that enters the lungs is always warm, and moist, and each new whiff is not so very different from the last one. Nothing we can do about it can change this condition either. In fact, if in very cold weather we run a race with open mouths and thereby change materially the temperature and condition of the air we pull into the lungs, the very dickens is to pay.

"In theatre heating and ventilating and temperature controlling we need the same sort of a governor, as this wind pipe so that no very different or very sudden thing can occur."

"Well, Uncle," said I, "after all, don't we need the same sort of governor in any heating and ventilating problem, where we are working on human beings or animals, for all buildings, not just theatres?"

"Maybe so," said he.

TO OUR READERS.

In order to bring THE HEATING AND VENTILATING MAGAZINE into the closest possible touch with its readers, and to give them the opportunity of expressing in detail the kinds of articles and topics they would like to see published, we present herewith a form especially designed for that purpose.

This form may be used, not only for submitting suggestions, but for asking questions pertaining to heating and ventilation, all of which will be given careful consideration and answers furnished to the questions asked.

It has often been said that heating men are loath to ask questions. We should like to prove that this is not so and, at the same time, to secure first-hand information regarding our readers' wants, to guide us in presenting the kind of reading matter they most desire.

If you have any ideas you would like to see exploited, or if there are subjects which you believe we should go into more extensively or cover in greater detail, let us hear from you. THE HEATING AND VENTILATING MAGAZINE is conducted strictly in the interests of its readers and their desires should be, and are, paramount. By co-operating with us in the manner suggested, you will not only be benefiting yourself, but many other readers as well who, very likely, are confronted with the same problems you are facing.

Fill this out and mail now, while the matter is fresh in your mind

Editorial Department,

Heating and Ventilating Magazine,

1123 Broadway, New York.

I should like to have you publish an article on.....

.....

.....

I should like information on.....

.....

.....

(In case your questions include problems in design, be sure to send sketches or blue prints of the layout.)

CORRESPONDENCE

Figuring Fixed Charges or Operating Costs.

EDITOR HEATING AND VENTILATING MAGAZINE:

For December, 1920, on Page 55, you gave a very useful chart. But it seems to me this chart must be completed as follows, to indicate if material and labor are in proper proportion to make the total direct cost.

Brussels, Belgium. A. LAURENT.

LEGAL DECISIONS

Valuation, Return and Rates for Steam Heating Plant.

In allocating jointly used property between the steam-heating and electric plants of the Central Illinois Light Company, the engineers of the Commission and the company both divided the boiler house, boilers, and the greater part of the jointly used plant equipment upon the basis of the respective maximum steam demands of the heat and electric utilities, expressed in boiler

A Chart of Fixed Charges or Operating Costs

Compiled from Actual Figures Obtained from Successful Heating and Plumbing Shops—Tabulated for a Growing Business.

ITEM	COLUMN	A	B	C	D	E	F	G	H	I	J	K	L
X	Volume of Business for Year	7,500	10,000	15,000	20,000	25,000	35,000	50,000	75,000	100,000	150,000	200,000	250,000
Y	Owners' Capital	750	1,000	1,500	2,000	2,500	3,500	5,000	7,500	10,000	10,000	12,000	15,000
Z	Borrowed Capital	425	675	850	1,000	1,500	2,000	3,000	4,000	4,000	5,000	5,000	6,000
	Overhead Accounts												
1	Misc. Office Expense (Sundries)	8	10	15	20	25	35	50	75	100	150	200	250
	Collections	(by the use of Cash Discount and Trade Acceptance, this item can be eliminated)											
	License Fee	5	5	5	5	5	5	5	5	5	5	5	5
	Telephone and Telegraph	65	75	100	125	125	125	125	135	145	145	150	160
		15	20	25				65	75	100	100		
18	Misc. Shop Expense	5	5	10	10	15	20	30	50	50	60	75	100
	Oil, Candles, Paint, Gasoline, etc.	(These items are merchandise, and should be charged to the individual job requiring them)											
19	Total of Fixed Charge or Operating Cost	2,263	2,941	4,239	5,663	6.783	9,234	13,115	17,009	19,804	23,590	26,842	31.075
20	Percentage of Overhead (To be added to the cost of labor and material)	49.7%	47.8%	45.1%	45.2%	42.5%	40.8%	40.5%	33.3%	27.9%	20.9%	17.3%	15.8%
21	Percentage of Overhead (Based on sale price)	30.2%	29.4%	28.3%	28.3%	27.1%	26.4%	26.2%	22.7%	19.8%	15.7%	13.4%	12.4%
22	Discount (That can be given from 100% list to make 10% profit)	17.6%	18.7%	20.2%	20.2%	21.6%	22.5%	22.7%	26.7%	29.6%	33.5%	35.5%	36.3%
23	Discount (That can be given from 100% list to make 10% profit if 5% is allowed for cash.)	13.4% + 5%	14.4% + 5%	16% + 5%	15.9% + 5%	17.5% + 5%	18.5% + 5%	18.6% + 5%	22.8% + 5%	25.9% + 5%	30% + 5%	32.6% + 5%	32.9% + 5%
24	Net Cash Profit for Year	682	909	1,364	1,818	2,273	3,182	4,545	6,818	9,091	13,636	18,182	22,727

Revised and Copyrighted 1920 by the National Trade Extension Bureau.

FIG. 1.—TABLE OF OPERATING COSTS COMPILED BY NATIONAL TRADE EXTENSION BUREAU.

19	Total of fixed charge (or Operating Cost)	2.263	2.941	4.239	5.663	6.783	9.234	13.115	17.009	19.804	23.590	26.842	31.075
20	Percentage of overhead (To be added to the cost of labor and material	49,7%	47,8%	45,1%	45,2%	42,5%	40,8 %	40,5 %	33,3 %	27,9 %	20,9 %	17,3 %	15,8 %
21	Percentage of overhead: Based on sale price	30,2 %	29,4%	28,3 %	28,3 %	27,1%	26,4 %	26,2 %	22,7 %	19,8 %	15,7 %	13,4 %	12,4 %
24	Net cash profit for year	682	909	1.364	1.818	2.273	3.182	4.545	6.818	9.091	13.636	18.182	22.727
25	Labor %	22 990	40 2.475	48 4.500	47 5.985	41,5 6.597	40 9.000	35 10.980	33 16.992	31,5 23.985	29 31.950	26 39.960	25,5 49.950
26	Material %	78 3.565	60 3.675	52 4.897	53 6.534	58,5 9.347	60 13.584	65 21 360	67 34.181	68,5 52.880	71 80.824	74 115.016	74,5 146.248
27	Total direct cost 100	100 4.555	100 6.150	100 9.397	100 12.519	100 15.944	100 22.584	100 32.340	100 51.173	100 76.865	100 112.774	100 154.976	100 196.198
	Total: 27+19=X (Vol. of business for year)												
		A	B	C	D	E	F	G	H	I	J	K	L

FIG. 2.—ADDITIONAL ENTRIES SUGGESTED BY CORRESPONDENT.

horse power, and each computed this proportion as 42% to the heat and 58% to electric utility. The Commission apportioned a non-condensing turbine between the two utilities. The fair value of the steam-heating property, including cash, working capital, materials and supplies, was fixed at $725,000. An allowance was made of $30,000 for working capital, and a specific allowance of $70,000 was made for going value. A return of 8% on the fair value of a steam-heating plant was held reasonable. An allowance of $18,000 was made for depreciation. The following rates for each month were fixed by the Commission: $1.60 per 1,000 lbs. for the condensation registered each month, up to and including 4,000 lbs.

$0.70 per 1,000 lbs. for excess condensation regestered each month over 4,000 up to 104,000 lbs.

$.60 per 1,000 lbs. over 104,000 up to 304,000 lbs.

$0.65 per 1,000 lbs. over 304,000 lbs. 0

Valuation, Return, and Rates for Water Heating Plant.

In fixing a schedule of water heating rates for the Laporte Gas and Electric Company, the Indiana Public Service Commission allowed $12,500 as the going value of the heating property, and $4,000 for working cash capital. The Commission found that the total value of the heating property was $187,500, and that the value of the depreciable heating property on which a rate of depreciation should be calculated was $155,000. A depreciation rate of 4½% on the value of the depreciable heating property, or $6,975, was allowed. The company was held entitled to a return of 8% on the total value of its heating property. The following Laporte water heating rates were fixed by the Commission's order.

DIRECT RADIATION

Per square foot when normal or standard amount of radiation is installed, 37 cents.

RANGE BOILERS

Range boilers from 40 gal. to 75 gal. capacity $15.

Range boilers larger than 75 gal. and those used for commercial purposes to be by special contract between the consumer and the company.

INDIRECT RADIATION

Indirect radiation is not recommended, but when installed shall be charged for at a rate 100% in excess of the rate for direct radiation.

This schedule was in effect during heating season 1920-21. The regular heating season is understood to be from October 1st to April 30th inclusive, when the outside temperature is at a point below 60° F. and such other times after September 14 and before May 21, when the outside temperature is 60° F., or below.

Basis for Fixing Hot Water Heating Rates.

In discussing the basis for fixing hot water heating rates as between the amount of radiation installed and the amount of radiation required, in the case of the Central Illinois Public Service Company, the Illinois Public Utilities Commission found that the computation of required radiation was in reality a determination of the amount of heat lost from the premises under consideration when a temperature of 70° F. is maintained with an outside temperature of 10° F. This heat must be supplied to the premises by the utility and is effected by the cooling of the circulating water as it passes through the consumer's radiators It would, therefore, appear that the required radiation is a measure of the use of the service and, in the absence of a device for measuring the actual number of heat units supplied, it should be used as the basis of a charge for service.

The New Director of the Research Laboratory.

FREDERICK PAUL ANDERSON
The New Director of the Heating Engineers' Research Laboratory.

Dean F. Paul Anderson, of the College of Engineering, University of Kentucky who, as announced in last month's issue, has been appointed director of the heating engineers' Research Laboratory in Pittsburgh, assumed his new office August 1. Acting Director L. A. Scipio, who has been in charge of the laboratory since the death of the late Director John R. Allen, in October, 1920, has returned to Constantinople to resume his duties as dean of Robert College.

In securing the services of Dean Anderson, the society's Research Committee feels that it has found a worthy successor to Director Allen. For more than 30 years Dean Anderson has been engaged in experimental work as professor of mechanical engineering, director of experimental laboratories, and dean of the College of Engineering of the University of Kentucky. Paralleling his university work, he was for 25 years engineer of tests for the Southern Railway Company.

Dean Anderson's career has been devoted entirely to engineering. Born in 1867, he was graduated from Purdue University in 1890, with the degree of B. M. E.; the degree of M. E. was granted him in 1894.

A portion of the year 1890 was spent as designer of special machinery with the Studebaker Company, at South Bend, which was his home city. Following that he spent approximately one year in experimental engineering work at Purdue University. In 1891 he was called to Lexington, Ky., as assistant professor of mechanical engineering in the State College of Kentucky. In the following year, 1892, he was made full professor of mechanical engineering and dean of the School of Mechanical and Electrical Engineering. In 1917 he was made dean of the College of Engineering, which position he has held to date; the name of the college was changed in 1908 to the University of Kentucky.

Dean Anderson is a member of the American Society of Mechanical Engineers and was recently elected a member of the American Society of Heating and Ventilating Engineers.

THE TREND FROM DOWN-DRAFT TO UP-DRAFT IN SMOKELESS BOILER DESIGN

The fact that three important manufacturers of down-draft smokeless house-heating boilers have recently changed their designs to up-draft has led to inquiries as to the causes for making this change. The boilers in question are the Monarch, manufactured by the Wm. H. Page Boiler Co.; the Peerless, manufactured by the Peerless Heater Company; and the Prox, manufactured by the Frank Prox Company.

In the case of the Monarch boiler, it should be stated that the down-draft type is still being made, the new up-draft design having been adopted to meet a demand for such a boiler.

In the case of the Prox boiler, the company states:

"Our reason for developing the up-draft type smoke-consuming boiler and discontinuing the down-draft type can be expressed in three words, 'To avoid trouble.'

"The down-draft boiler, first of all, required that we have two sets of patterns and two complete equipments of core boxes, flasks, etc., in our foundry. Then we had to carry two complete stocks of boilers, one of the down-draft and one of the surface-burning type.

"Then we had to go out and sell the down-draft boilers at a great expense and, after they were sold, if the contractor had not installed a down-draft boiler before, we had to inspect the boiler after the installation and show him how to fire it so that he could, in turn, show the owner and janitors how to do it. Then came the continuous complaint of the owner finding coke or unburned coal in the ashes, due to improper firing.

"Then often came the complaint that the boiler did not have sufficient draft, due to stacks not being of sufficient size, and in most cases not having sufficient height to burn the fuel on the down-draft principle.

"If a down-draft boiler was installed on a job with insufficient radiation, and a boiler too small for the job, the boiler could not be forced to carry the job for the reason that down-draft boilers will not stand forcing. There were also many other reasons.

"With the up-draft boiler we use all of our surface-burning boiler equipment except the special air-inlet sections, consequently only one stock of sections is required for each type. Then we do not have to go out and show the other fellow how to fire the boiler. He can force the boiler to make more steam without losing a lot of coal in the ashes.

"The Prox single-grate up-draft smokeless boiler will burn the cheapest grades of soft coal without objectionable smoke and requires less attention than the ordinary soft coal boiler, and any unskilled man who can keep water in the boiler, keep the ashes from under the grates and throw in coal when needed, is all that is required to operate the boiler. Prox up-draft boilers have been installed in many of the large cities where the smoke inspectors had to be 'shown,' and in every case the boilers made good beyond any question.

"We have eliminated all of our troubles, also those of the fitter and owner in this up-draft type of boiler."

A similar position is taken by the Peerless Heater Company. "The down-draft boiler," writes the company, "served its purpose while in vogue, but owing to the fact that it required so much attention to properly operate, requiring janitor service at all times, it was found necessary to bring into existence a boiler requiring less attention and yet similar in results, namely, smoke consuming.

"From results of investigations and exhaustive tests, the up-draft single-grate smokeless boiler has been perfected and all grades of soft coal, as well as hard coal and coke, can be burned without the objectionable smoke nuisance.

"We believe that in constructing the bridge wall section so that it is protected by the water, it being a hollow section with an outlet to the crown sheet, giving perfect circulation, we have in the Peerless the best and most efficient boiler of this type."

As was noted in THE HEATING AND VENTILATING MAGAZINE for August, 1921, the new Peerless boiler combines all the patented features of the Peerless construction, including the "S" circulating arms in the firepot, adding materially to the boiler's prime surface. The boiler is made without any fire-brick wall or hot-blast cast-iron chamber, as all parts that come in contact with the fire are surrounded by water. In addition, the super-heated secondary air is regulated by the operation of the dampers, so as to maintain the secondary air at an intense heat where it is introduced at the bridge wall. This is intended to obviate the difficulty of holding the steam pressure when the fire is checked, due to a large volume of cold air going in from the outside.

Smokeless City Not a Dream.

Dr. Charles P. Steinmetz, chief consulting engineer of the General Electric Company and one of the most prominent scientists of the country, forecasts the time when we shall have smokeless cities, the heat as well as the light for buildings being supplied by electricity.

In connection with this he emphasizes the necessity of greater economy in the use of our power resources. In 1918, says Dr. Steinmetz, 857,000,000 tons of coal were used in the United States. "Using the coal produced in one year as building material," he says, "we could build with it a wall like the Chinese wall around the United States, following the Canadian and Mexican frontiers, and the Atlantic, Gulf and Pacific Coasts—a distance not of hundreds, but of thousands of miles. And with the chemical energy contained in the next year's coal production, we could lift this entire wall up into space for a distance of 200 miles."

According to Dr. Steinmetz, the maximum amount of energy that may be generated by utilizing our water power resources may be estimated at 370,000,000 h. p. which, he says, is a little more than the total energy of all forms that we now produce from coal, and is about equal to the present total consumption of energy of all forms in this country. Therefore we cannot reason that when the coal is gone we have only to develop our water power resources to the greatest possible extent. Were they all developed today to their maximum efficiency they would furnish only enough power for present-day uses, with no provision for the constant and enormously increasing use of electricity.

If we used coal that is burned for heat only to generate power as a by-product, and utilized the heat that is a wasted by-product when coal is used to generate power, we should effect a great saving, he maintains.

That greater economy in the use of fuel and in the more efficient use of power plants through distributing their work through a greater number of hours is necessary, he points out, as indicated by the fact that the supply of coal is rapidly being depleted, and there is nothing except the hydraulic resources mentioned to take its place so far as known sources of energy are concerned.—*From the Sibley Journal.*

Suggestions for Putting the Heating System in Order.

Suggestions for getting the heating system in shape before the arrival of cold weather are contained in a report of the Heat Utilization Committee of the National District Heating Association. While the suggestions are intended primarily for users of central station heat, they apply with equal force to individual heating plants:

Radiator valves should be thoroughly gone over and made tight, as otherwise leakage will occur and steam be used at times when heat is not needed. Further, the radiator valves should be made easier to operate in the winter, as otherwise a customer will open his windows rather than close off the heat in his radiators.

Radiator traps should be cleaned out and any necessary repairs made to prevent condensation in return lines. While such condensation will furnish heat to the building, this heat will generally be furnished at a time when it is not necessary, having the effect of over-heating the building, thereby causing waste.

Vacuum pumps should be thoroughly looked after and put in good condition.

With a heating system in proper operation water jets are not necessary ahead of vacuum pumps and they should be eliminated in all cases for they cause a larger consumption of steam than is necessary, besides wasting large quantities of water.

It is essential that all pipe covering be repaired, that leaks be eliminated and that traps be cleaned and tight.

The heating system should be checked to eliminate pockets in the piping caused by settlement of the equipment or building.

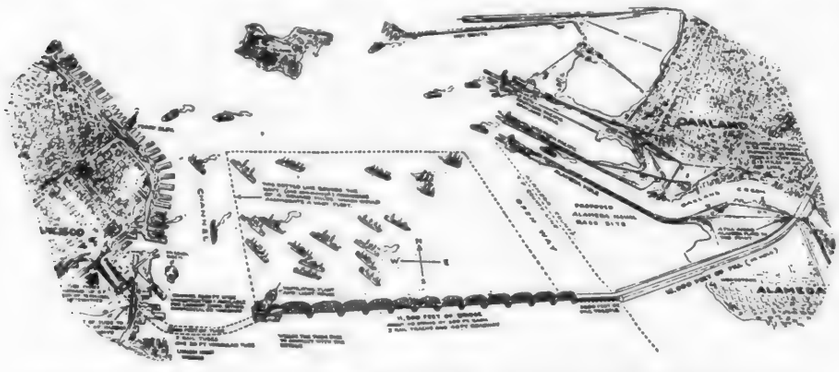
Windows and doors should be put in good order and weather strips installed in order to prevent as much loss of heat as possible from this source. In the aggre-

gate this loss is enormous and can generally be prevented by a relatively samll investment.

For the first six months in 1921 the average temperature has been some five degrees above normal and as the average temperature for an entire year is very constant, it is safe to assume that the Fall and Winter will be cold; consequently, as far as it is possible to do so, all heating installations should be put in first-class shape before the start of the cold weather.

Project to Span San Francisco Bay With Combined Bridge and Tunnel.

Preliminary plans have been completed by J. Vipond Davies and Ralph Modjeski for a combination bridge and tunnel to span San Francisco Bay. The proposed structure, if erected, will extend from Oakland across Oakland Creek through the Alameda flats on a fill ending at the Alameda County line, thence across a fill trestle and span bridge to a point about a half-mile from the San Francisco shore front. From this point to the San Francisco terminus the route would be covered through an underwater tube. While bridge-tube combinations are not a novelty, the design which proposes junction



PROPOSED BRIDGE-TUNNEL COMBINATION TO SPAN SAN FRANCISCO BAY

at a point that distance from shore, certainly can be so considered. This Davies-Modjeski plan, by means of the tube section, avoids a complete blocking of the inner bay to ship traffic. The channel under which the tube passes is ample for the passage of ocean liners and the span bridge piers would act as a sort of breakwater so that the inner bay would show smooth water practically always.

The bridge section of the route will carry two lines of railroad tracks, a 40-ft. roadway for vehicle traffic, and a sidewalk for pedestrians. No estimate is contained in the plans as to the density of pedestrian traffic on this route totalling about five miles in length. In the tunnel section, according to these plans, each railroad track will occupy a separate tube, while a third tube will accommodate a 20-ft. vehicle roadway, together with the sidewalk for pedestrians.

Ventilation of the bridge section of this route will be entirely automatic, but special provision has to be made for the tunnel section, particularly in view of the automobile traffic anticipated. The plans contain provision for this requirement in the form of blast fans at the bridge end of the tunnel to force in fresh air and suction fans at the city end to expel foul air. The fresh air is to be admitted at the sides of the vehicle and passenger tube at road level and exhausted to a foul air duct above the roof of this tube. The fan equipment is to be double the requirements of the tunnel to insure continuity of service in case of fan troubles.

Engineering Ethics for Architects.

The practice by some architects of relying for engineering advice upon the staff of the contractor, is severely arraigned in a recent bulletin of the Illinois Society of Architects by John D. Small. This writer takes the position that the 6% commission regularly paid to architects, entitles the owner to expert engineering service in connection with his project, rather than the biased advice of the contractor who has personal interest in the specifications, which may easily oppose the interests of the owner.

From the standpoint of the contractor also, the practice is declared by Mr. Small to be a bad one, because the contractor has no normal need of the engineering talent qualified to give expert advice of this character, and is not warranted in securing such additions to his staff when, as so frequently happens, the contractor who gives the advice is not the one who secures the contract. If there is an understanding that the furnishing of gratis advice on engineering points will ensure the securing of the contract, the process of bidding becomes a farce and the owner's interests suffer.

Mentioned as even worse than the use of contractor's services along engineering lines, is the use of services offered by manufacturers who have natural prejudice in favor of their own apparatus and whose specifications are bound to include equipment of their own make. Even where there is provision for payment of an engineering fee in case the manufacturer's own product is not used, Mr. Small holds the practice inimical to the owner's best interests.

Three methods are suggested by this writer for securing expert engineering advice on building projects; the employment of competent engineers by the architects as members of their staffs; the use of services offered by consulting engineers with independent practices and organizations; and the use of services offered by engineering service bureaus. The latter method is suggested as an effective way to handle small jobs where the commission involved is not large enough to repay the consulting engineer for the time and attention required for effective results. Such an engineering service bureau would be maintained by cooperation between the architectural and the engineering professions in any locality, according to Mr. Small's plan.

Research Activities of the British Institution of Heating and Ventilating Engineers.

At the summer meeting of the Institution of Heating and Ventilating Engineers, held at Sheffield in June, a report was presented by Edgar Herring, representing the Research Committee, bearing upon the work conducted at University College. He announced a grant of £650 from the Government Department of Scientific and Industrial Research which brought the available financial resources of the Committee up to about £825. The committee expects to proceed now with the printing of Bulletin No. 1 on coefficients of heat losses from building materials. In the course of the investigations on this subject, a difference of opinion developed between the Research Committee and the Government Department regarding the need for tests on thin materials. It was the contention of the committee that such tests should be made and that lack of information on heat losses through thin materials is seriously handicapping heating engineers in dealing with modern structures.

Film to Aid Coal Conservation.

The power of the motion picture screen has been harnessed to the task of impressing upon American citizens the need of conserving coal. Word has been received from C. J. Stover, secretary of the Pipe and Boiler Covering Manufacturers' Association, that a one-reel film entitled "A Dollar Saved is a Dollar Earned," which picturizes how the coal bill can be cut down in the average home by the insulation of boiler and pipes, has been presented to the United States Bureau of Mines library of educational films, and will be circulated by the bureau throughout the country. In addition to this circulation, prints of the films will be available to distributing agencies, such as the Red Cross, Y. M. C. A., etc., which loan education films to churches, schools and lodges without rental charge, the same as Carnegie library loans books free.

The picture was produced under the auspices of the Pipe and Boiler Covering Manufacturers of the United States by the Rothacker Film Company of Chicago, which has made a number of the films now in the bureau's library.

This film will be furnished without charge upon application to the U. S. Bureau of Mines.

TYPES OF WATER SERVICE HEATERS

II

BY MRS. OLIVE E. FRANK.

Service heaters may be divided into two general groups—the water-tube type and the steam-tube type. Instantaneous heaters are of the water-tube type and storage-tank heaters of the steam-tube type.

Regardless of the type of heater, the method of heat transmission is the same; i. e., the water is heated by coming in contact with hot metal walls, usually tubes, which are heated by steam or other gases, and the method of calculating the heating surface is the same in all cases, and is

$$A = \frac{H}{CD}$$

where

H = total amount of heat to be transmitted or the pounds of water per hour multiplied by the temperature rise.

D = mean temperature difference between the water and heat medium.

C = coefficient of transmission.

The above formula is used to estimate the quantity of heating surface required for a storage-tank or steam-tube type of heater. In this type, where the steam is passing through the tubes and the water circulating around the tubes by gravity, the velocity of the water does not enter into the calculation of the problem; i. e. with reference to C.

However, in the water-tube type of heater, where the rate of heat transmission is influenced by the velocity of the water passing through the tubes, this formula is modified as follows:

$$A = \frac{H}{K \times \sqrt{V} \times D}$$

K = a constant varying with the size, character and condition of the tube.

V = velocity of the water.

The value of V varies for any given service in the various designs of heaters; i. e., the heater with small tubes will have a much higher velocity than the heater with the same number of larger tubes in the water-tube type; whereas V is very small indeed in the steam-tube type where there is any large storage capacity. Most investigators consider that the rate of heat transmission varies as the square root of the velocity; i. e., in the formula they use the square root of V. The value of K is a variable one, depending as it does on the size, character and condition of the tube. In the case of the steam-tube type, the greatest variation in the value of K is due to the condition of the tube itself; and the size and the character of the tube have very little effect, the cause of the variation in K being largely due to the amount of scale or other foreign matter on the inside and outside of the tube, which, in extreme cases, may almost entirely prevent the transmission of heat.

Since most liquids are poor conductors of heat, the heating is accomplished by convection rather than conduction; and that heater which breaks up the water most rapidly and presents new particles of water to the heating surface gives the highest rate of heat transmission. This is pointed out very clearly in Bulletin No. 40 of the Engineering Experiment Station of the University of Illinois, entitled "A Study in Heat Transmission," where the authors state that it is the rate of agitation that produces the change in heat transmission, defining the rate of agitation as the number of times per second that each particle of water comes in contact with the tube. The value of K has been determined by experiment to be as high as 1600 for small clean tubes with the water flowing through the tubes; whereas in the steam-tube type this value would not exceed 250. In fact, one large manufacturer of steam-tube heaters bases his design of heater on a value of C of 110.

From the foregoing it can easily be seen that, unless there are some other conditions which are considered more important, the most efficient type of heater is the one in which the velocity is high, where the water is broken up into small columns and these columns agitated. There is, of course, a minimum smaller than which it is not desirable to make the tubes, because with decreased size of tubes comes increased frictional resistance and consequent loss of head.

SUGGESTIONS FOR WRITERS OF SPECIFICATIONS.

When the engineer or contractor writes his specifications for heaters, is it not a good plan to first decide whether the requirements are such that an instantaneous heater will suit the conditions of service or a storage-tank type of heater, and then call for the type required and specify the number of gallons of water per given period, the initial and final temperatures of the water, and state the temperature or pressure of the steam available. This will permit each manufacturer interested to furnish a heater of their standard construction properly designed to meet the requirements, and at a better price than if they are compelled to bid on a certain number of square feet of heating surface, consisting of a stated diameter of tubes of specified material.

For instance, in the instantaneous or water-tube type of heater a large number of square feet of heating surface may be supplied, consisting of large-diameter tubes poorly arranged as to length and number of passes, and the velocity would be so low that the heater would not fulfill the requirements; whereas, another heater of small-diameter tubes, of proper length, and arranged in the number of passes to give a higher velocity may have only half the quantity of heating surface and yet be an efficient heater and perform more work than the first heater mentioned.

Do not buy mere quantities of metals, but be sure that the heater you specify or buy is properly designed for the service intended.

With reference to the selection of a suitable type of heater, consider the following: Instantaneous heaters are used in hospitals, hotels, factories, and other similar institutions where there are constant heavy demands for hot water. Storage-tank heaters are suitable where the steam supply is limited or intermittent, and it is desired to store up as much hot water as possible for domestic service. They are very often called for in laundry work, where the demands come at intervals, and it is required to have a large quantity of water to refill the washers.

Storage tanks are frequently provided in hotels to take care of their peak load, and most engineers agree that this peak load comes in the morning when the bath rooms are in use, together with the kitchen and the laundry. They also agree that this peak load is not a five-minute peak, but continuous for about two hours, and since the storage-tank heater has a capac-

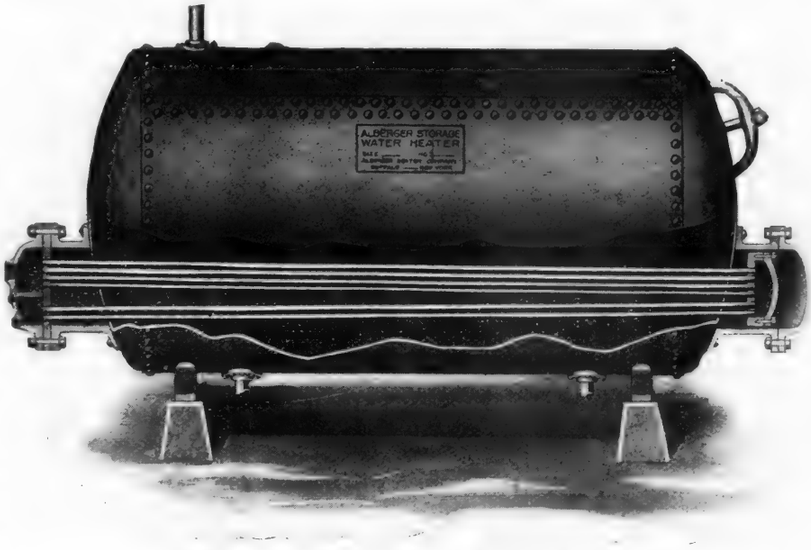


FIG. 2.—ALBERGER STORAGE WATER HEATER

ity equal to from one-fifth to one-third of its hourly heating capacity; i. e., if it has a heating capacity of from 3000 to 5000 gal. per hour, it usually has a storage capacity of not more than 1000 gal., and if the peak load is continuous for one-half hour, all benefit of the storage tank is lost.

The writer has a case in mind, where a 1000-gal. storage tank was specified for hotel service to contain a heating element of capacity to heat 10,000 gal. of water per hour. This is poor practice because the storage capacity will only accommodate about a five-minute peak load and, after that, the heater will function precisely as an instantaneous heater, with the exception that it will not be efficient, because it was designed presumably with large diameter tubes having the steam through the tubes, and is, of course, not efficient for instantaneous service.

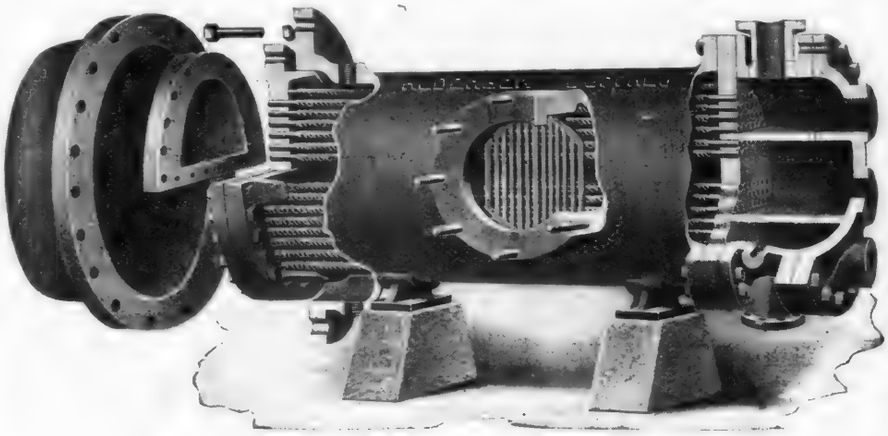


FIG. 1.—ALBERGER INSTANTANEOUS WATER HEATER

Another case, that of a new hospital installation where the engineer questioned the plans of the consulting engineer because he specified instantaneous heaters, saying that for a capacity of 5,000 gal. of water or more it would seem that a storage-tank heater should be used, and that an instantaneous heater did not look large enough to do the work. The explanation given was that the hospital had almost a constant demand for hot water for a period of seven hours and this demand did not vary over 100 or 200 gal. per hour, so that to furnish a storage tank heater to carry the peak load, would have meant a tank larger than would be practical to install, for it would have to carry a seven-hour peak load.

SECURING STORAGE CAPACITY BY CONNECTING INSTANTANEOUS HEATER TO TANK.

A storage capacity may also be available by connecting an instantaneous heater to a tank. In the first place, when an instantaneous heater is used higher efficiency is assured at minimum cost for steam consumption, cleaning and repairs. Second, there is a corrosive effect on the steel shell of a storage-tank heater which materially lessens the life of the heater, but with a separate tank and heater properly bypassed, the tank may be cut out of service for periodical cleaning and painting without greatly decreasing the hot water supply; thereby, prolonging the life of the tank. When storage tanks with combined heating elements are used, two installations are often required, so in case of trouble with one unit, the other will be available, whereas, with the separate heater and tank, only one installation is necessary.

Fig. 1 illustrates an instantaneous heater made by the Alberger Heater Company, Buffalo, N. Y. All parts are made of cast-iron with the exception of the tubes, which are ¾ in. O. D. of seamless drawn copper. These tubes are spirally corrugated to increase their efficiency by agitating the water and bringing every particle instantly in contact with the heating surface. This heater is provided with divided floating heads to accommodate expansion and contraction. It is known as the Alberger multi-head heater. It is made in both horizontal and vertical types, and besides hot water service, it is adapted to feed-water installations, heating systems, swimming pools, and many other demands.

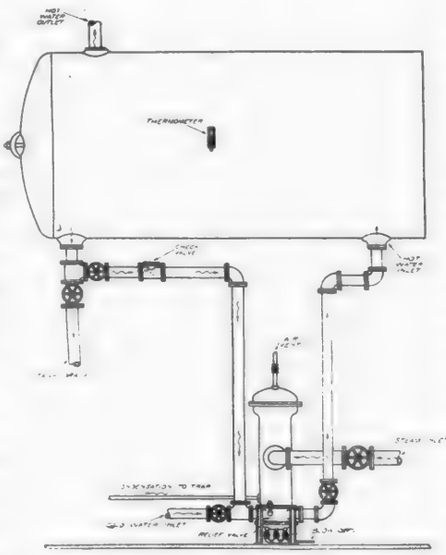


FIG. 3.—INSTANTANEOUS WATER HEATER AND STORAGE TANK COMBINED

Fig. 2 pictures an Alberger storage water heater. This is constructed of a steel shell, and fitted with a tube nest consisting of 1¼ in. O. D. seamless drawn copper tubes, plain, not corrugated. Expansion and contraction is also accommodated in this type by means of a floating head which rides in a tank flange connected to the shell, and so arranged that both ends of all tubes are accessible without removing the entire tube nest from the heater, in case of cleaning or repair. While it is possible to remove the nest of tubes in the Alberger storage water heater, it is not necessary to go to this expense and trouble, as the small covers can be easily removed.

Fig. 3 shows the installation of the storage tank and instantaneous heater combined. Here the instantaneous heater should be designed so as to offer little frictional resistance, providing easy circulation from the tank to the heater, in order to obtain the best results.

Deaths.

CHARLES MORRISON, of Boston, Mass., manufacturers' agent for boilers, radiators and heating specialties, died in the Melrose (Mass.) Hospital, August 3, of embolism of the heart. He was 53 years old. Mr. Morrison was formerly with the Walker & Pratt Mfg. Company and the Gurney Heater Mfg. Company, and was a well-known figure in the trade. He was a regular attendant at trade conventions and was favored with an unusually wide circle of friends. He is survived by a widow and one son.

FRANK E. WOODWARD, head of the heating engineering firm of Frank E. Woodward & Co., Boston, Mass., died in a hospital in Brookline, August 5. He was 68 years old. Early in his business career, Mr. Woodward entered the employ of the Magee Furnace Company and in 1887 became a director of the corporation. Later he was placed in charge of the company's heating and ventilating department. He organized the firm of Frank E. Woodward & Company in 1905. One of his four sons, Ernest C. Woodward, was associated in business with him at the time of his death. His widow and four daughters also survive.

PIERCE PACKLESS VALVES are described in a recent pamphlet of the Pierce, Butler & Pierce Manufacturing Corporation, New York. Sectional views of the valve show pictorially its construction and operation. The packless feature of the valve is secured by the pressure of a compression spring upon the under face of the stem seat which is cast integral with the valve stem. A wear-resisting stem disc is thereby pressed betwen the upper face of the stem seat and the under face of the top nut. This pressure is vertical and therefore 100% effective against the leakage tendency which is horizontal. Opening and closing of this valve is secured by the rise and fall of a lower stem section Another feature of this packless valve to which the pamphlet calls special attention is the fact that the valve may be closed and the upper stem removed for replacement of the stem disc without escape of steam and with a minimum of time and effort. The fact that this valve can be opened or closed with a single turn of the handle is mentioned as giving both convenience and durability.

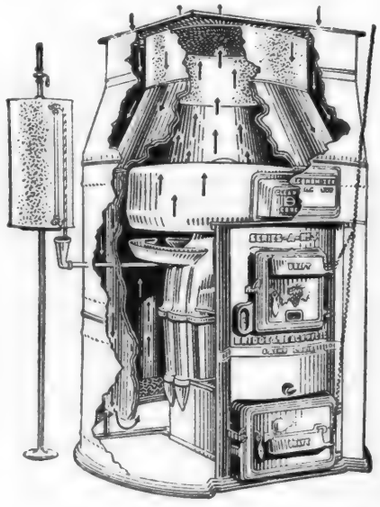
HUMIDIFYING DEVICES FOR THE HOME

No. 9—Wright-Marshall Air Moistener.

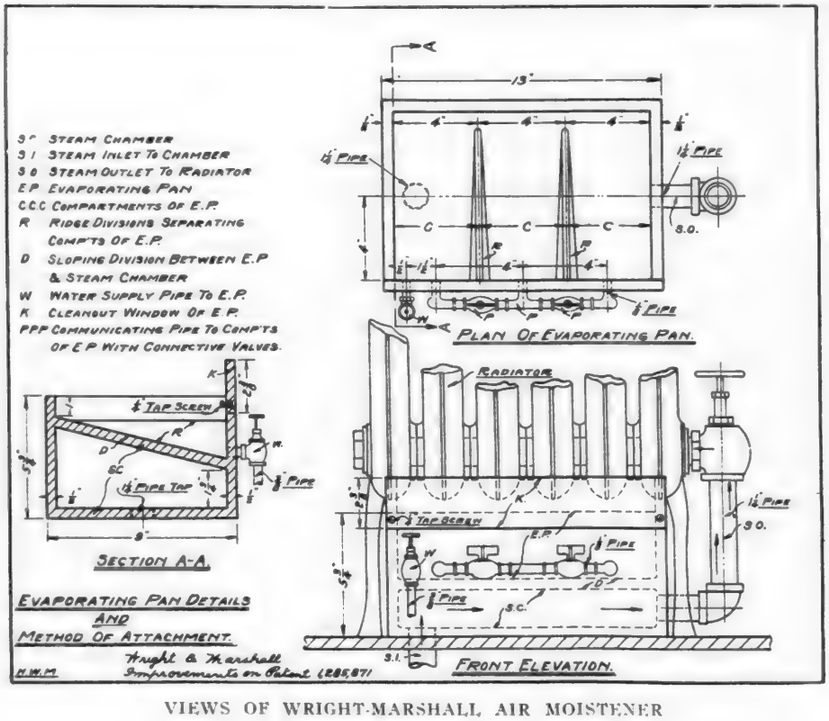
In the attempt to secure more effective humidification of room air the radiator has been attacked from pretty nearly every angle. The air moistening apparatus patented by J. Wright and W. H. Marshall of Pleasantville, N. Y., goes at it from under the radiator. Unlike some of its contemporaries, this device is not portable, being in the form of a cast-iron box upon which the radiator rests. This box is divided by a sloping web into two compartments. The upper of these contains the water to be evaporated and through the lower is passed the medium, steam or hot water, by which the radiators are heated. This serves to increase evaporation and the vapor from the water pan, or upper section, rising impinges on the heated walls of the radiator and is thereby mixed with the air and circulated with it into the room. The water level in the evaporators is maintained constant from a storage tank equipped with float valve on supply and an overflow pipe to prevent flooding. The arrangement seems as if it might give good evaporation without very much attention.

No. 10—Bridge-Beach Humidifier.

There are no design intricacies in connection with the humidifying apparatus manufactured by the Bridge-Beach Manufacturing Co., St. Louis, Mo., for use in connection with its air heaters. With these humidifiers the process of humidification is treated as simply one of evaporating water and this is accomplished by placing the water in pans where it will evaporate fastest, that is, right in the air stream around the combustion chamber. No attempt is made in this apparatus to regulate or restrict the degree or rate of evaporation; the surface of the water is entirely exposed to the air stream. The pans, curved in form to fit around the combustion chamber, are supported by rods projecting from the walls of the latter. The Bridge-Beach slogan is "A gallon a day evaporation per room" and provision is made for the filling of the evaporating pans without recourse to the bucket method. Instead, the turning of a faucet accomplishes the duty without trouble or mess and a vacuum-controlled supply tank feeds the water to the pans as fast as required.



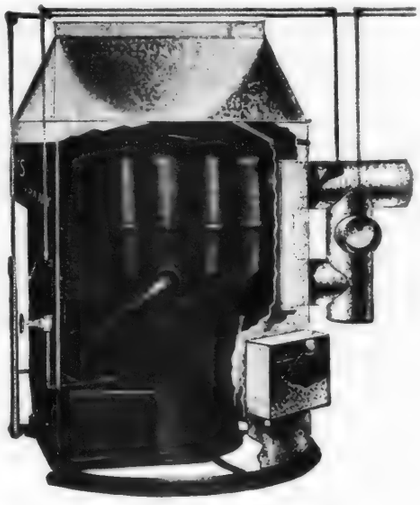
BRIDGE-BEACH HUMIDIFIER


S Steam Chamber
S I Steam Inlet To Chamber
S O Steam Outlet To Radiator
E P Evaporating Pan
C C C Compartments Of E.P.
R Ridge Divisions Separating Compts Of E.P.
D Sloping Division Between E.P & Steam Chamber
W Water Supply Pipe To E.P.
K Cleanout Window Of E.P.
P P P Communicating Pipe To Compts Of E.P With Connective Valves.
Section A-A.
Plan Of Evaporating Pan.
Front Elevation.
Radiator
Evaporating Pan Details And Method Of Attachment.
Wright & Marshall Improvements on Patent (1285871)

VIEWS OF WRIGHT-MARSHALL AIR MOISTENER

No. 11—Buck's Humidifier.

Another humidifier of the kind that is designed for exclusive use with a certain make of warm-air furnace, is that manufactured by the Buck's Stove & Range Co., St. Louis, Mo. Nothing could be simpler than this apparatus which consists of an evaporating pan of ample depth and capacity, resting on bracket supports in the path of the air currents and connected to a supply tank equipped with a float valve regulator by which can be secured a constant water level in the humidifier. This tank is connected directly to the supply main. A distinct feature of the evaporating pan is the curved contour which allows it to fit snugly against the combustion chamber.



BUCK'S HUMIDIFIER

No. 12—Savo Air Moistener.

Another humidifier of the radiator pan type is the Savo air moistener, made by the Savo Manufacturing Co., Chicago, Ill.

FRONT BACK
VIEWS OF SAVO AIR MOISTENER

This device hangs back of the radiator with curved hook supports which fit over the top between sections. A distinctive feature of the Savo moistener design is the fact that its inner face which rests against

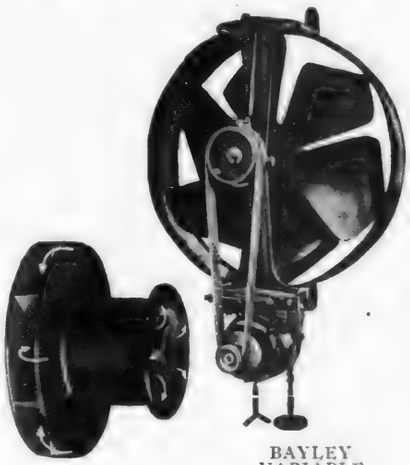
the radiator is vertically corrugated to fit in the spaces between sections. In this way the capacity of the water container is increased without increasing the distance between the radiator sections and the outer face of the pan. This type of humidifier is made in four sizes to suit the capacity requirements of different-sized rooms. To meet the humidification requirements of a pipeless furnace, or of any type of warm-air furnace having floor registers, the same company has developed a humidifier designed to fit into the flue under the register face. Warm air passing upward through the center passage and around the periphery of this device serves to evaporate the water contained within it. The Savo devices derive their name from the fact that they are claimed to save 25% of the coal bills by permitting less heat in connection with greater humidity.

SAVO MOISTENER FOR FLOOR REGISTERS

New Apparatus and Appliances

Electric Disc Fan With Variable Speed Features.

Another addition to the growing line of Bayley products is the Bayley Junior electric disc fan, recently announced by the Bayley Manufacturing Co., of Milwaukee, Wis. This fan is described as a variable-speed fan with a constant-speed motor and the speed variation is produced by variation of the tension on the belt connecting fan and motor. A hand wheel attached to an elongated screw, with swivveled end fixture, allows the motor to be raised or lowered, thus decreasing or increasing the belt tension and the fan speed, the motor speed being constant. Belt replacements can be made quickly by removing the guard which is placed around fan and motor pulleys and belt as a safety measure.



BAYLEY VENTILATED PULLEY

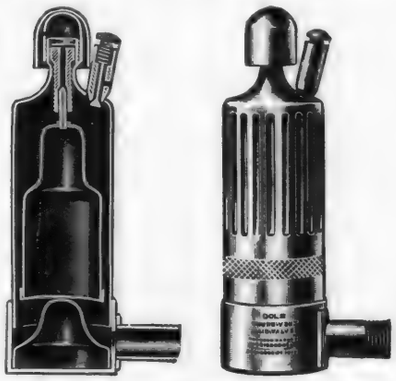
BAYLEY VARIABLE SPEED DISC FAN

The special ventilated pulley with which the motor is equipped deserves particular mention, inasmuch as it reverses the principles of centrifugal fan operation, sucking in air at the fan periphery and discharging it along the hub axis. For this pulley comprises a miniature fan designed to cool the pulley and prevent excessive heating of the same even under heavy slippage friction incidental to the low-speed ratios of fan to motor. By keeping the pulley cool it is obviously prevented from burning the belt. The manufacturers claim that this is the fresh air fan that "fresh-air fans" have been looking for.

Dole Shure-Vent Air Valve.

The Dole Shure-Vent air valve, a new device manufactured by the Dole Valve Co., of Chicago, Ill., operates on the recognized thermostatic principle of expansion and contraction. A simple improvement on the air valve principle makes certain the practical as well as the theoretical functioning of the Dole automatic air-valve, the venting of the radiator.

In ordinary automatic valves there is no provision for water-logging or for the collection of flake and dirt to clog the working parts. Both of these troubles will probably occur with the best of air valves. Ordinarily the only remedy is to take off the valve and shake out the dirt and water.

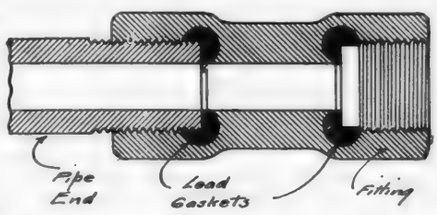


SECTION EXTERIOR DOLE SHURE-VENT VALVE

But the push button on the side of the Dole Shure-Vent valve corrects this trouble. Should it become necessary, this valve can be quickly emptied of water by pressing this button. This permits air to enter the top of the valve, breaking the vacuum that holds the water so that this water can run back into the radiator and permit the valve to again function properly. Should flake or dirt work under the seat of the valve, it is carried back into the radiator by the receding water. Even if the valve-seat should become completely sealed with dirt, holding down the push button for a few moments will completely vent and heat the entire radiator.

A Leak-Proof Design for Pipe Fittings.

A patent has been granted recently to Harry F. Peck, of Wakefield, Mass., on his design of a means for making pipe fittings of all kinds leak-proof. The main feature of this design is its provision for inserting a packing ring or gasket of lead, or other soft metal, in the body of the fitting. In using such fitting the pipe end is brought to bear against this soft metal and the threads on the pipe cut their way into this metal for a short distance making a joint that is extraordinarily tight without the use of white lead, litharge, or other sealing paint on the joint.



PECK PATENTED LEAK-PROOF DESIGN FOR PIPE FITTINGS

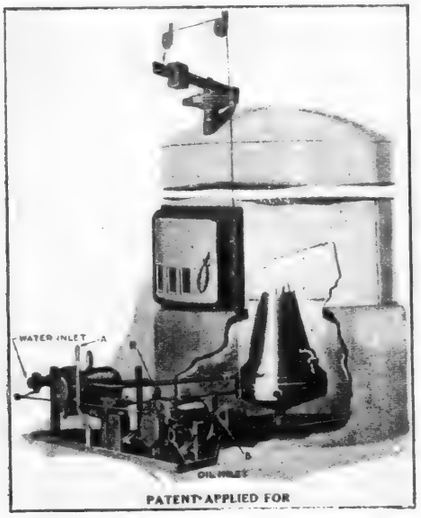
Another feature of this patented design is the provision of a reduction in the body of the fitting so that the interior diameter of the fitting is approximately the same as the interior diameter of the corresponding size of pipe. This, together with the character of seal above described, tends to produce a fitted joint without the disturbance of flow usual to such joints as have an enlarged interior diameter at the fitting. The accompanying sketch shows a section of a union, but the principle is adaptable to any kind of screwed fitting.

A Self-Regulating Water-Oil Burner.

An oil burner for use in furnaces, water heaters, boilers, and similar service as a substitute for coal, has been developed by the Guardian Oil Burner Corporation, Brooklyn, N. Y. The feature of this apparatus which draws first notice is the fact that it includes no provision for spraying the oil and no fan, pump, or other device for forcing it into the combustion chamber, or for forcing in an air stream as an aid to combustion. There is a blast effect produced, but this is secured by chemical and physical means, instead of mechanically.

The apparatus is simple and the parts small. Aside from the valves for cutting on or off the fuel and water supplies, there is but one part which moves—the device for maintaining constant oil level in the

burner—and even this motion is so gradual as to be unnoticeable. The oil and water feed circuits are interesting. Oil supply is kept in an inverted tank which feeds first into a cone-shaped pan through a valve so arranged that the oil level in this pan is maintained practically constant. From this pan the oil flows to the leveling device above mentioned, consisting of a horizontal cylinder swung on hollow trunnions (through which the oil enters and leaves) and equipped with a float-operated valve. From the other end of the cylinder projects a rod which is attached to the pressure regulator arm by means of the usual chain. In this way the oil supply to the boiler is adjusted to the amount required to produce a given steam pressure. From this leveling device the oil flows to the burner which is another inverted cone,



SECTION VIEW OF GUARDIAN OIL BURNER

similar to the pan previously mentioned.

Water is fed to the apparatus through a leveling device like that on the oil line, with the exception that this is set by hand instead of automatically. From this device the water flows to a boiler which consists of an annular ring of rectangular cross-section, setting near the bottom of the burner above the fuel cone. A pipe from the boiler back to the water leveling device serves to equalize the pressure in the latter and thus enables it to perform its necessary function. Another pipe leads from the boiler to a coil near the top of the burner and steam passing through this coil is dissociated into its component gases, hydrogen and oxygen, which pass down through a vertical pipe from the top of the coil to a burner resting in the fuel cone. At the tips of this burner the oxygen and hydrogen again unite, issuing in the form of jets of flame at high pressure and high temperature. This is the blast effect produced in this burner and it serves to draw in air for combustion of the fuel, through vertical passages in the fuel cone. At the top of the burner is placed a deflector which directs the flames and hot gases partly down and outward so that the sides as well as the top of the combustion chamber are heated.

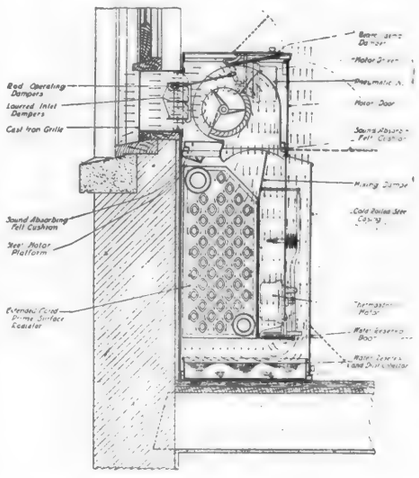
According to the manufacturers, this dissociation and re-ignition of the gases, oxygen and hydrogen, in the water supply results in some gain in heat, but it is not apparent just how this can be secured. The water is fed in cold and passes out in the same quantity, as heated vapor. This must mean a loss of heat. The heat gained by re-ignition of the gases can not possibly exceed that lost in the process of dissociation. What seems to be the real advantage of this process is that it supplies the necessary blast effect without the use of pump, fan, motor, or other complicated moving parts.

The apparatus is started by opening the fuel and water supply valves and igniting the oil in the fuel cone. This burns for about five or ten minutes with a smoky flame until the superheating coil has become hot enough to start dissociation of the superheated steam. Then the jets begin to work and the blast produced by them results in complete combustion of the oil, and smoking ceases. During operation the effect of the burner is not unlike that of a big bunsen burner or gas torch, except that the deflector breaks up the tip of this flame so as to spread it in various directions. The apparatus is shut down by simply closing the fuel and water inlet valves and this process is followed by a gradual dropping of the blast and finally by a short period of smoking as the last oil in the fuel cone is consumed. The manufacturers claim that this apparatus will operate satisfactorily and continuously on crude oil at 8 cents a gallon, or $8 per hundred gallons, which, they state, is the equivalent of a ton of coal in B. T. U. content. The apparatus is set in place by removing the ash-pit door and in operation the top of the burner is at about the same level as would be the top of the fuel bed if coal fuel were being used.

Peerless Unit Ventilator.

For certain conditions of combined heating and ventilating, the use of the unit ventilator, so-called, has received increasing attention during the past few years and several large manufacturers of fan and blower apparatus have recognized the movement by providing standard designs of unit ventilators as part of their regular product. Other designs have been put forward by concerns specializing in this form of equipment and among those of this origin is the Peerless unit ventilator, manufactured by the Peerless Unit Ventilation Co., of New York.

An idea of the operation and construction of the latest type of the Peerless unit ventilator is given in the accompanying sectional view of the interior mechanism. In this design fresh air from out of doors is introduced through a cast-iron grille and louvre dampers to twin fans (motor driven) located at the top of the ventilator casing. Where recirculation is desired this stream of fresh outdoor air is augmented by a stream of recirculated air, admitted through the recirculation damper at the top of the casing. Whatever the character of the feed air, it enters the fans and is blown downward. At this point provision is made for another service variation in the placing of a mixing damper so that this downward air stream can be divided into two parts and the relation between these parts adjusted to the desired degree of tempering. The first part passes down and over the surface of the radiator (or better called a convector in this case,



SECTIONAL SIDE ELEVATION PEERLESS UNIT ELEVATOR

because it accomplishes its function largely by convection) and is thereby warmed, after which it is joined by the second part (unheated air) and the combined streams are partly cleaned and humidified by passing over a water reservoir at the bottom of the unit. From here they pass upward and out into the room through a register grille located at about the height of a radiator top from the floor. The mixing damper is capable of automatic thermostat control for maintaining any desired temperature of delivered air, or hand control can be furnished if desired.

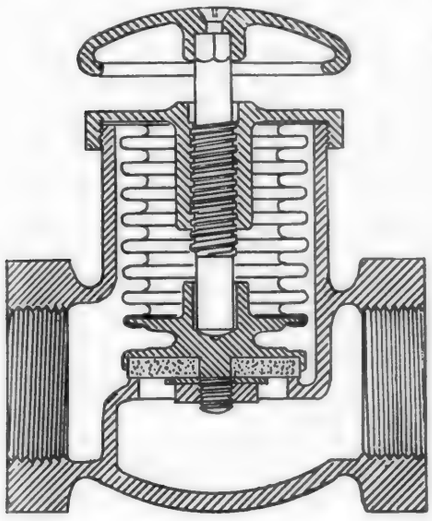
The principal points advanced by the manufacturer are that the unit provides independent service for each room at a cost proportional to the work required, eliminating expense of heating and ventilating rooms that are not in use; that the unit is adaptable to all steam conditions, working equally well on either high or low pressure steam supply and with either exhaust, vacuum, or modulation systems; and that the units can be used to supplement or to replace an existing heating system, without expensive remodeling.

Self-Opening Packless Valve.

In the operation of this valve, manufactured by the Fulton Company, Knoxville, Tenn., the opening is not a process which could occur without manual control and the difference lies simply in the fact that with this valve the control serves to limit the action of the corrugated spring, or sylphon, by which the actual positive act of opening is performed. Closing of the valve is quite positive, on the other hand, since in this case the control is working in the opposite direction from the pull of the sylphon.

By reference to the illustration it will be apparent how the packless feature of this valve is secured by means of the air-

tight joints at upper and lower ends of the corrugated spring. A replaceable composition disc at the working end of the



FULTON SELF-OPENING PACKLESS VALVE

valve stem, seats horizontally over a port of ample diameter.

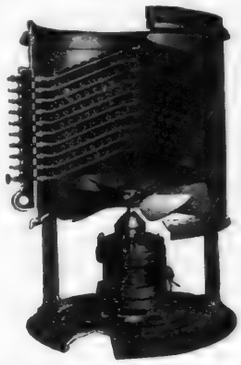
Bayley Thermo Unit.

A recent addition to the increasing number of available unit heater types is the Bayley thermo unit, made by the Bayley Manufacturing Co., Milwaukee, Wis. The unit presents an appearance of simplicity, neatness and durability. It consists of a cast-iron base plate of circular form at the center of which is placed an electric motor mounted with shaft vertical. A fan of the familiar disc type is carried at

BAYLEY THERMO UNIT

the upper end of this shaft and supplies the motive power for forcing air through the unit. Extending up from the fan is a metal cylinder attached to the base plate by three vertical supports, and this cylinder carries the curved heating coils by which the air supply is warmed. Steam is supplied to a single manifold or header, forming part of the cylinder and each coil helix can be valved into this header independently so that the range of heat control is greatly extended. The header has two chambers, one for supply and the other for return so that both steam and return pipes are connected to the same header.

The B. T. U., as this unit heater is called in the company's literature, is made at present in six sizes varying from 24 to 60 in. in diameter and from about 50 to 75 in. in height. It can be obtained



SECTIONAL VIEW BAYLEY THERMO UNIT

with either direct-current, single-phase, or polyphase motor. Top breechings are supplied universal (eight-way), four-way, or two-way as desired, at an additional cost. The principal claims made for this unit heater are compactness, adaptability and efficiency.

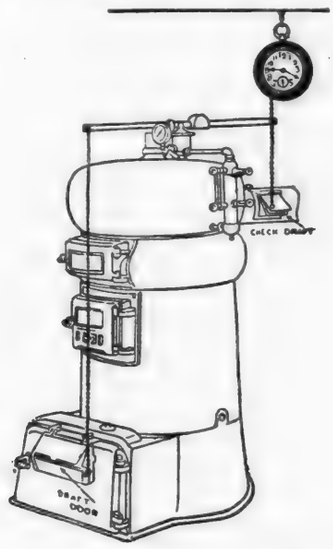
Tidey Furnace Clock.

In place of the usual bell and reciprocating hammer with which nerves are shattered and dispositons ruined by the ordinary alarm clock, the Tidey Furnace Clock, manufactured by the Tidey Heat Specialties Co., New York, has a releasing hook attachment by which at the proper hour on cold winter mornings, the drafts of the furnace, or boiler, may be opened and the heating system spurred to increased efforts.

Aside from the clock, whose internal mysteries probably resemble closely those of other clocks, there is nothing complicated about the Tidey system of draft control. A system of chains and pulleys is

TIDEY FURNACE CLOCK

rigged up to the furnace or boiler drafts and so arranged that during the night the stoking door and check draft are open, while the draft is closed. When the hook releases at a set hour in the morning, a weight pulls closed the stoking door and check draft and opens the draft door, and



STEAM BOILER WITH TIDEY CLOCK

at once the fire starts to pick up its heating load for the day. There is no difference in the handling of the fire except that an ample supply of coal must be stoked when the fire is banked at night. The only extra operations incidental to this mechanism are winding the clock at suitable intervals and setting it each night when fixing the fire for the night.

A Hydraulic Vacuum Generator for Steam Heating Systems.

On the principle of the well-known Penberthy injector, operates the hydraulic vacuum generator recently perfected by the Penberthy Injector Company, of Detroit, Mich. This principle is that when a jet of fluid or gas is allowed to shoot through an opening of which the cross-section is first reduced and then increased, the stream will create a suction strong enough so that its action can be compared to that of a pump and used in the same way. In the injector, of established value, this action is used to introduce feed water into a boiler without recourse to pumping apparatus and operations and in this service the working fluid is steam.

As adapted for use on steam heating systems, however, the apparatus is operated by water from the domestic water supply pipes and is put in service only as conditions demand. When the system is air tight this device is semi-automatic in that it will cease operation as soon as a vacuum has been created. The method of operation under this condition is quite simple. When it is desired to improve the vacuum and thus augment the heating effect of the system, the operating lever is raised, allowing the passage of a steam of water through the device by way of the inlet valve. The passage of this stream of water acts to create a vacuum, both in the system and in a diaphram operated mechanism connected to the operating lever. The vacuum is maintained in the system by

means of a double check float valve, but when this vacuum has reached a definite degree the diaphram acts to pull down the operating lever and close the inlet valve, thus terminating the action of the whole device until again opened manually.

Sure-Hot Water Heater.

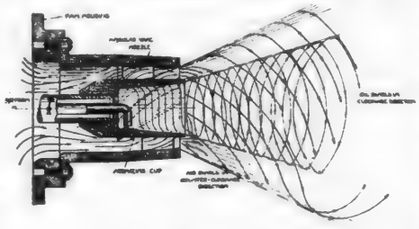
Nothing could be simpler than the Sure-Hot water heater, manufactured by the Whitlock Coil Pipe Co., Hartford, Conn. It consists of a flanged cylinder of cast-iron to which are attached two similar end castings, the body of the heater between flanges being lagged with asbestos pipe covering as heat insulation. The heater is installed with axis vertical and both heating and heated water flow in at the bottom and out at the top. The heating coil consists of a helix of copper tubing tested to be tight at 200 lbs. pressure while the heater shell is tested to 30 lbs. pressure. Where special provision has not been made for attaching the heater below the water line of the steam boiler, an alternative method is suggested of connecting the heater into the lower gauge glass connection and the return main. Either method insures a continuous flow of heating water at all times when the boiler is in service.

New Publications.

THE FUNCTIONS OF THE ENGINEERING EXPERIMENT STATION OF THE UNIVERSITY OF ILLINOIS, by Director Charles Russ Richards, is the title of Circular No. 9 published by the University of Illinois, Urbana, Ill. The text is brief and to the point. Opening with general discussion on the value of industrial research, the pamphlet outlines the movement which resulted in the organization of this experiment station, the character of the problems presented to it, technical publications, general engineering information service, the training of men for research work, commercial tests and investigations, co-operative research, patents and investigations in progress, which include the investigation of friction losses and power requirements in the proposed ventilating system for the New York and New Jersey Vehicular Tunnel, in co-operation with the United States Bureau of Mines acting for the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission.

Trade Literature.

RAY ROTARY FUEL OIL BURNERS are discussed in full in a booklet, recently received from the W. S. Ray Manufacturing Co., San Francisco, Cal. This manufacturer has developed a method and device by which the fuel oil can be delivered from the burner nozzle in one direction of rotation while the air blast is delivered from the same nozzle in the opposite direction of rotation. This effect is produced with a single rotating member by suitable design of the angular vanes in the air path. The same principle applied to a centrifugal fan would result in obtaining either up or down blast at the periphery of the same fan wheel, or impeller, by simply changing the slope of deflecting blades. The pamphlet is well illustrated, containing a diagram which shows how



NOZZLE DESIGN IN RAY ROTARY FUEL OIL BURNER

this action is secured, together with views of the Ray burner in section and as applied to oil-burning boilers. A table of sizes and capacities is included. Size 9 x 12 in. Pp. 8.

TEMPERATURE REGULATING SYSTEMS, electrically operated, as manufactured by the Gold Car Heating & Lighting Co., Brooklyn, N. Y., find favorable mention in a recent catalog of that company. This catalog opens with a preamble and closes with a testimonial and between the two there is conveyed considerable information regarding Gold standards. As to the economy of automatic temperature regulation, it is stated that an Eastern mercantile concern has figured that each cold in its office force costs the company $24, directly or indirectly. Excesses of both heat and cold are shown to be avoidable by use of Gold's system of electrically-operated temperature regulation. The catalog explains the method of operation and shows views of Gold's standard, flush-type and cylinder-type thermostats, electro-magnetic and thermo-electric radiator valves, and motors. Installation plans and specifications are then given, together with a word as to proper care of these thermostatic control devices. Size 8½ x 11 in. Pp. 32.

AEROLOGICAL INSTRUMENTS, for ventilation and air condition test work, are explained in detail in a catalog recently issued by the E. Vernon Hill Co., Chicago, Ill. This covers the psychrobook, a pocket-size case containing psychrometric and comfort charts and thermometer for both dry and wet-bulb temperature readings; the air current machine, a device for producing a cloud of ammonium chloride which is at room temperature and which remains suspended in the air for a considerable period, permitting accurate observations of air currents; the dust counter, which is used to project a stream of the air sample against a glass plate covered with transparent adhesive substance that retains the dust particles and enables counting of the same and, by this means, determination of the dust content of the air sample. Other apparatus described is the pocket microscope, the bacteria culture outfit, the odorometer, and the air-sampling apparatus, all made by the same concern. These various pieces of apparatus are sold either separately or assembled in the air-test case for ventilation and air-conditioning field work. The pamphlet gives prices and illustrated descriptions of these devices. Size 4 x 9 in. Pp. 12.

Fulton Company's New Plant.

With the erection and completion of a large valve machine shop and other improvements, the Fulton Co., of Knoxville, Tenn., has the distinction of having the largest plant in the world devoted to the manufacture of thermostatic instruments. The plant itself is modern-built, of reinforced concrete, three stories high, and has a floor space of over 250,000 sq. ft. Adjoining the main plant is a well-equipped research laboratory in charge of President Fulton, head of the company.

The company, whose entire product has as its essential element the seamless metal bellows known as the Sylphon, operates its own brass foundry and iron foundry. Complete pattern shop, tool room, machine shop, forging plant and box factory are also incorporated within the plant.

In the plant itself modern equipment is found throughout. Hydroelectric power is used for operating the machines and each department is supplied with separate meters for gas, water and electricity. The company also operates a restaurant for the benefit of many of its employees.

NEW PLANT OF THE FULTON COMPANY

THOS. J. DOUGLASS & Co., 441 North Dearborn St., Chicago, Ill., engineers and contractors, have taken over the business of the Air Moistener Co., manufacturer of the Steamo air moisteners. From now on these devices will be manufactured under the name of Thos. J. Douglass & Company.

In many homes, particularly town houses or apartments, the space for the heating boiler is very small and frequently adjoins the entrance hall. The IDEAL Type "A" Heat Machine is admirably designed for plans of this character

Economy of Fuel and Space

"It burned 40% LESS COAL this year."—This statement from a grateful owner exceeds the tabulated results from hundreds of installations of IDEAL Type "A" Heat Machines—which average **A FUEL SAVING OF ONE-THIRD.** Besides this fuel economy, this reduced amount of coal requires one-third less storage space, and caretaking.

The **Large Fuel Chamber** holds enough coal to run without attention from 8 to 24 hours, depending upon weather demands.

The **Revertible Flues** and scientifically proportioned surfaces absorb and utilize the heat, preventing its waste up the chimney.

The **Automatic Regulation** prevents waste of heat by controlling the fire to supply the exact volume of heat needed—avoiding *under*-heating and *over*-heating..

The **Ideal Insulated Jacket,** dust-free and gas-tight, permits converting the basement into livable, recreational quarters.

We offer testimonial letters from many prominent users. Specify and use IDEAL Type "A" HEAT MACHINES for NEW or OLD residences.

Write for catalog containing test charts of FUEL ECONOMY and efficiency.

IDEAL Type "A" Heat Machine

IDEAL products are nationally priced and sold by all heating contractors. No exclusive Agents.

AMERICAN RADIATOR COMPANY

Sales Branches in All Large cities

Makers of the world-famous IDEAL Boilers *and* AMERICAN Radiators

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

HEAT LOSS TABLES

ROOFS

	Thickness T	Used by U. of Pa. A.	German Gov. B	Austrian Gov.(Mason) G	Thompson Ha	Greene I	Buffalo Forge Co. J	Hubbard L	Tweed Q	Nat. Dist. Heat. Assn R	Pract. Eng. S	Amer. Rad. Co. T	Donnelly X	Harrison M	H. & V. Magazine W	Irwin N
Cinder fill, Concrete	2"	.80					.80			.80						
	4"	.60			.60		.60	.60	.60	.60		Green & Co. Cast Iron Radr			.60	
	6"	.53			.54		.54	.54	.50	.54					.54	
Thickness not given												.60	.428		Slate & Gravel Roofing	
Wood Sheathing, Tiling		AA		GG	HHa		JJ			RR		TT		MM	WW	ZZ
	⅜-1"	.80			.80		.80			.80					.80	1.0
Tiling, No Boards under														Tile Roofing		Tiling with Wood Framing
	No Boards Under	1.12		.99						1.12		1.23		1.9		
Book or Government Tile, Wood Ceiling		AAA				III				RRR						
	2½-3"	.28								.25						
	Book Tile	.25				.25										
	Gov't Tile	.35				.35										

ROOFS

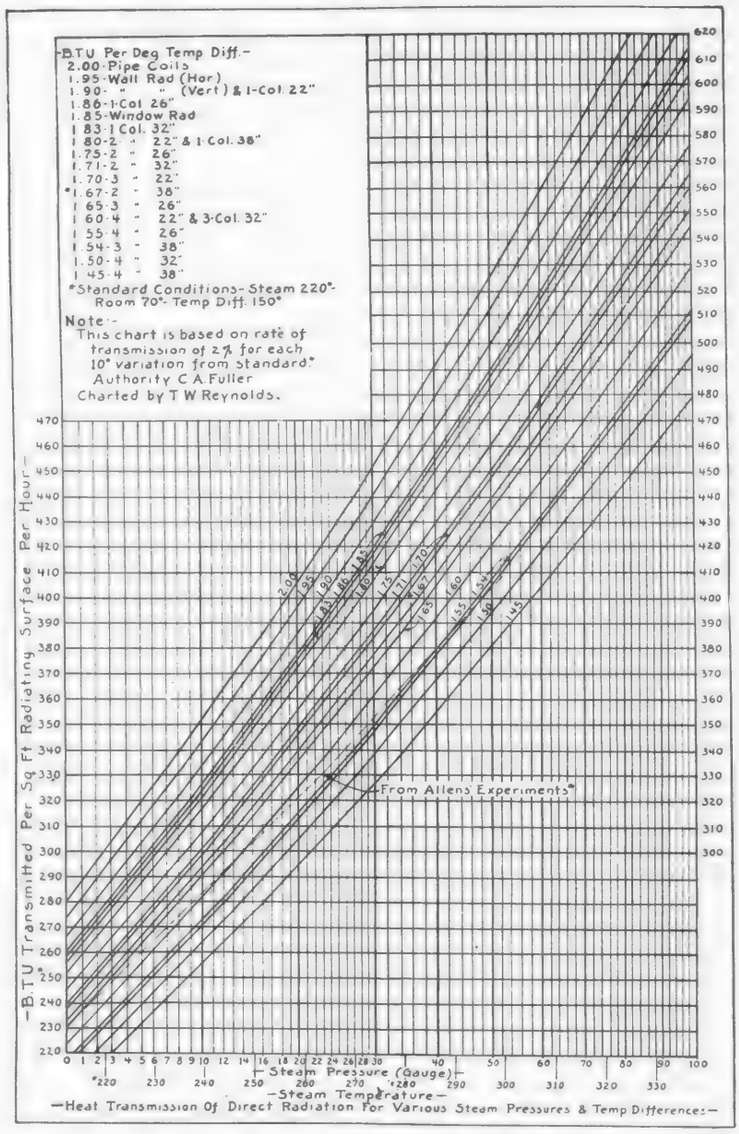
	Thickness	Used by U. of Pa. A.	Austrian Gov. Macon G	Thompson Ha	Buffalo Forge J	Hubbard L	Harrison M	Tweed Q	Nat'l. Dist. Htg. Assn. R	Pract. Eng. S	Amer. Rad. Co. T	Donnelly X	H & V. Magazine W	Irwin N
Metal Unlined														
Iron, Wood Framing	Unlined Metal	1.30		1.30		1.30			1.26				1.30	
	Iron	1.30		1.32	1.20 System Radr. Iron			1.20 Green Radr. Co.	Gurney Ash Sales Mfrs.					
End View, Corrugated Iron, Wood Framing		AA	GG		JJ		MM	QQ	RR					ZZ
		1.87	2.13		1.5		2.14	1.5	1.81					2.14 With ½" Framing
Metal, T & G Boards or Tight Wood Sheathing		AAA	GGG	Hasb		LLL	MMM		RRR		TTT	XXX	WWW	ZZZ
	Iron	.28		.17		.17			.28		.17		.17	
	Copper or Zinc	.45	.44				.45		.44					.45 On 1" Boards
	Tin	.31										.314		
Slate, Shingle Lath		AAAA		HHHHa	JJJJ				BBBB	BBBB			WWWW	
		.88		.80	.85				.83	1.1			.80	
				HHHHb .82										
Slate, Wood Sheathing or T & G Boards		AAAA	BBBBC	HHHHa	JJJJ	LLLL	MMMM	OOOOO	RRRRR		TTTT	XXXX	WW WWW	ZZ ZZZ
		.38	.43	.30 Tight Wood Sheathing	.43 On 1" Boards	.30	.45 For Copper Zinc & Slate	.43	.39 On 1" Boards		.30	.371	.30	.43 On 1" Boards
				.30										

B. T. U. LOSSES—Jones Tables. No. 1-ZZZ

(This concludes the Jones Heat Loss Tables.)

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

HEAT TRANSMISSION FROM DIRECT RADIATORS


—B.T.U Per Deg Temp Diff.—
2.00-Pipe Coils
1.95-Wall Rad (Hor.)
1.90- " " (Vert.) & 1-Col. 22"
1.86-1-Col. 26"
1.85-Window Rad
1.83-1 Col. 32"
1.80-2 " 22" & 1-Col. 38"
1.75-2 " 26"
1.71-2 " 32"
1.70-3 " 22"
*1.67-2 " 38"
1.65-3 " 26"
1.60-4 " 22" & 3-Col. 32"
1.55-4 " 26"
1.54-3 " 38"
1.50-4 " 32"
1.45-4 " 38"
*Standard Conditions-Steam 220°-Room 70°-Temp Diff. 150°
Note:-
This chart is based on rate of transmission of 2% for each 10° variation from standard.
Authority C.A. Fuller
Charted by T.W. Reynolds.
—B.T.U Transmitted Per Sq Ft Radiating Surface Per Hour—
From Allens Experiments*
—Steam Pressure (Gauge)—
—Steam Temperature—
—Heat Transmission Of Direct Radiation For Various Steam Pressures & Temp Differences:—

EXAMPLE: Assume a room temperature of 60° F. and a steam temperature of 230° F., which gives a temperature difference of 170°. This is 20° more than the standard conditions of 150°, and allowing 2% for each 10° variation, the values must be increased 4%. Assuming a 2-col. radiator 32 in. high, the factor is 1.71.

$1.71 \times 0.04 = 0.068$.

$1.71 + 0.068 = 1.778$ B. T. U. per degree difference.

$1.778 \times 170 = 302$ B. T. U. transmitted per square foot per hour.

RADIATION COMPUTING—Transmission from Direct Radiators 13-D

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

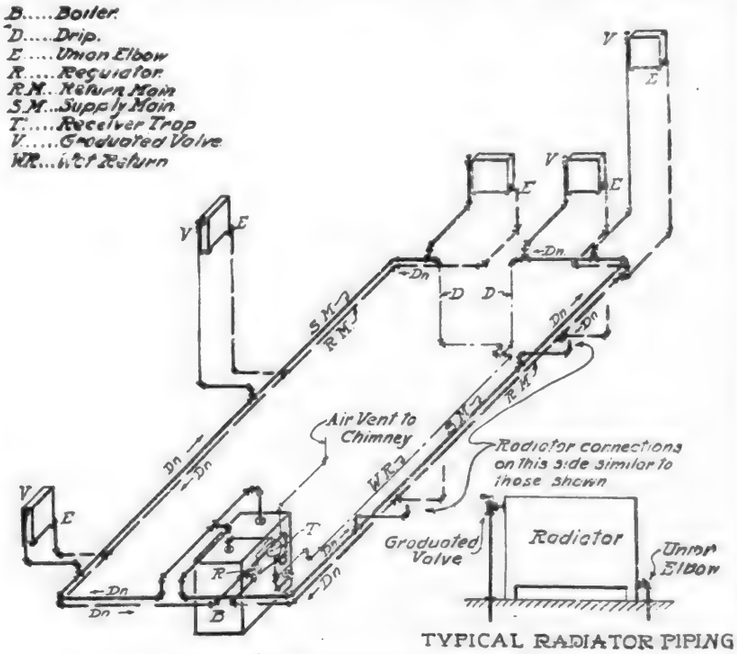
VAPOR HEATING.

The Hutchison System.

A distinctive feature of the Hutchison system, developed by the Hutchison Vapor Heating Corporation, Washington, D. C., is the fact that there is no trap at the individual radiators, the returns being trapped at the boiler by means of the Hutchison trap-receiver and damper regulator combination, shown in Fig. 3.

In Fig. 1 is shown a typical connections diagram for this system. Steam or vapor generated at the boiler flows out through the supply mains and risers and is admitted to the radiators through the Hutchison packless graduating valve (Fig. 2) of which there is one at the inlet end of each radiator. Condensation leaves the radiators through the Hutchison union elbow (Fig. 4) and is fed through the return lines to the trap-receiver at the boiler.

The Hutchison damper regulator is operated by the weight of water which is forced into its reservoir from the trap-receiver upon a rise of boiler pressure and which passes from this reservoir into the trap-receiver upon a fall of boiler pressure. This regulator



-HUTCHISON SYSTEM-

is adjustable from 2 to 6 oz. pressure by simply changing the setting of the reservoir on its indicator plate and figures opposite each setting on this plate show the pressure of the setting.

Hutchison special safety valves of the side lever, pop type are supplied in four sizes from 1 in. to 2 in. for boilers of 700 to 3500 sq. ft. radiation; for larger sizes it is recommended that 2 in. safety valves be used, arranged in tandem.

In installing this system the mains should be graded not less than 1 in. in 20 ft. when steam and condensation flow in the same direction, and not less than 3 in. in 20 ft. when steam and condensation flow in opposite directions. An addition of 20% to computations of required steam radiation is suggested, to insure complete condensation of the vapor in the radiator and keep steam out of the return lines. Radiators should be of the water type, tapped for top supply and bottom return, the return tapping being eccentric and either at the same or opposite end of the radiator from the steam connection. Return lines are vented to the atmosphere, and the vent line must be carried up at least 10 ft. above the level of the return line.

(*Concluded on Sheet No.* 132-Y)

VAPOR HEATING

The Hutchison System

(Concluded from Data Sheet No. 132-X)

The Hutchison graduating valve is of the packless type which opens and closes a port by the movement of a tapering slot attached to the valve spindle across the port opening as illustrated in Fig. 2. An extension valve stem is supplied for use in connection with enclosed or concealed radiators.

Pipe size for supply mains depends on the amount of radiation to be heated, the distance from the boiler to the furthest radiator, and the number of elbows contained

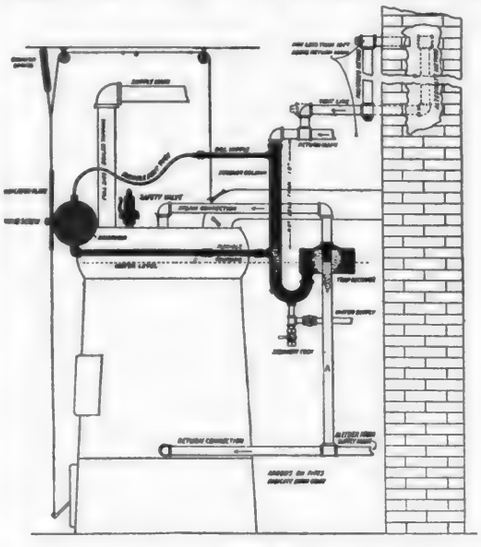


Fig. 3

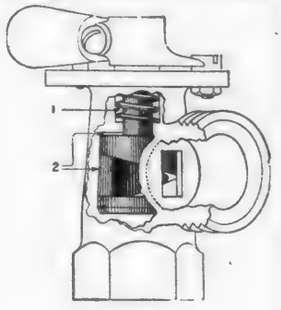


Fig. 2

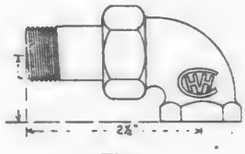
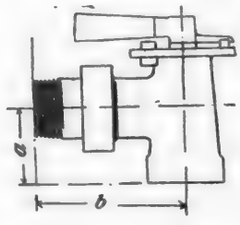


Fig. 4

in such line. The following table is calculated on the basis of an assumed pressure drop of 2 oz. between the boiler and the last radiator. In making measurements an allowance of 10 ft. for each right-angle elbow is suggested.

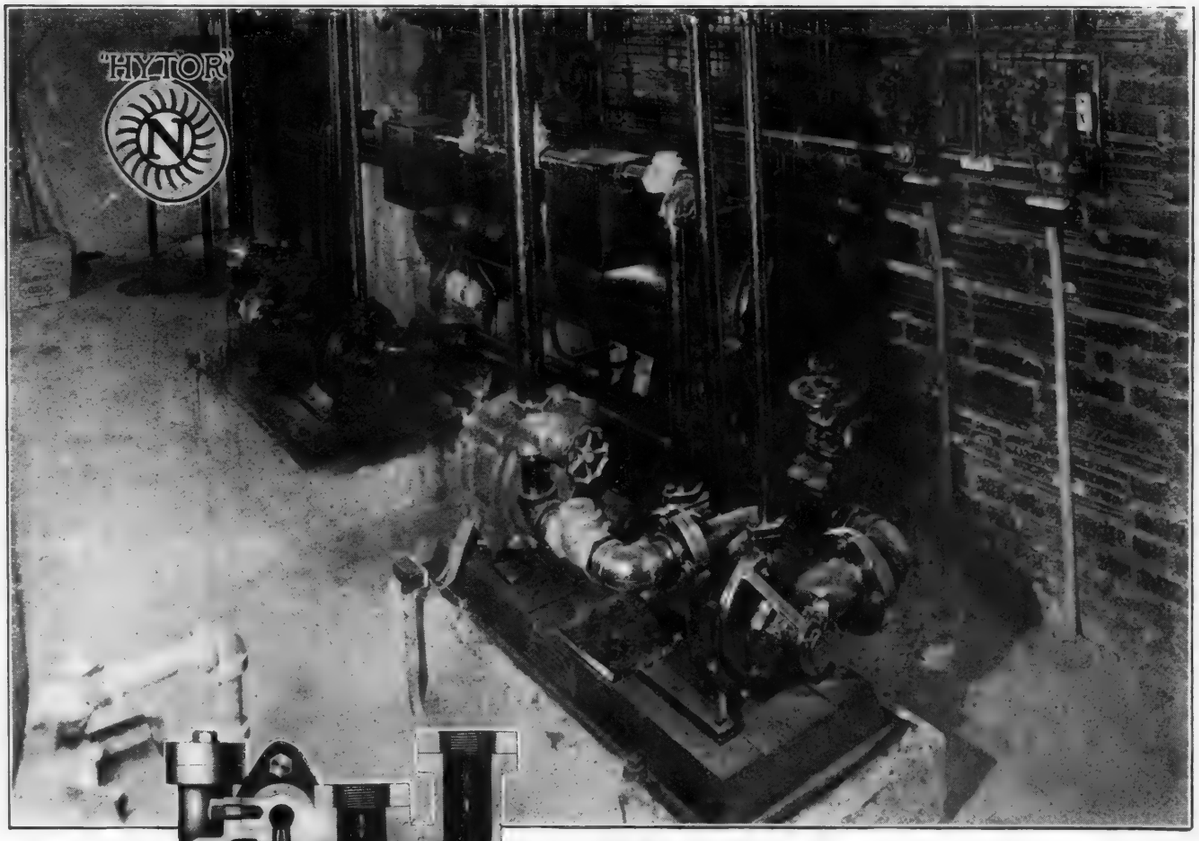
Nominal Size of Pipe In. Diam.	Length of Run of Main in Lineal Ft. — Radiation in Square Feet. 100 ft. or less	100-150 ft.	150-200 ft.	200-300 ft.
1¼	160	145	122	100
1½	265	210	190	150
2	520	450	380	310
2½	860	700	600	490
3	1500	1250	1070	900
3½	2200	1800	1550	1250
4	3300	2600	2200	1800
4½	4500	3700	3200	2600
5	6200	5000	4400	3600
6	....	8400	7200	5800

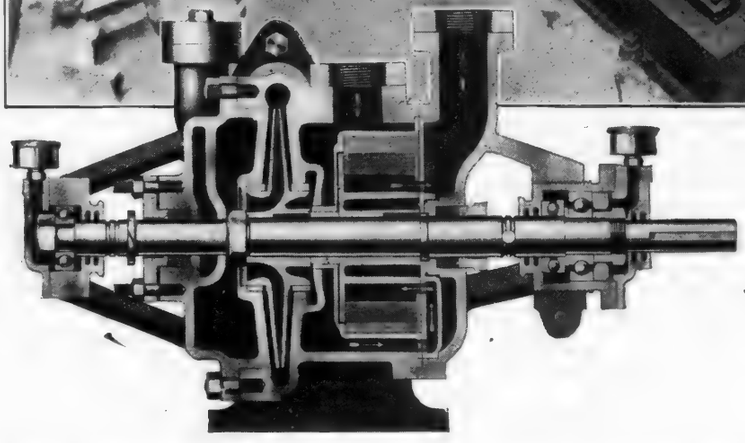


Roughing in Measurements for Radiator Valves

Sizes	*a*	*b*
1 inch	1⅞ inches	3¼ inches
¾ "	1⅜ "	3 "
½ "	1¼ "	3 "

EFFICIENT HEATING
demands the JENNINGS PUMP





Duplex E Unit, Automatic Operation.

Rudge & Guenzel Dept. Store
Lincoln, Neb.

Capacity each pump 65,000 sq. ft. direct radiation; air capacity, 42 cubic feet per minute, in addition to a water capacity of 90 gallons per minute.

The motors are only five-horse power.

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty per cent. In other words, the cost of current to operate is cut in half

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball-bearings mounted outside of casing. Moving parts revolve without contact.

A quiet, reliable operation with minimum expense for repairs and without annoyance because of shut-downs, is assured if the Jennings Pump is installed on your Vacuum Heating System.

There are many other reasons why the Jennings Pump is being installed in practically all of the important buildings. Bulletin 15 gives them in detail. Write for it.

The NASH ENGINEERING COMPANY
SOUTH NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

National Federation of Construction Industries announces the appointment of Warner S. Hays as general secretary, succeeding J. L. Clarkson who was recently made assistant to the president of the John R. Wiggins Co., Inc., prominent builders of Philadelphia. Mr. Hays is a consulting electrical, industrial management and industrial relations engineer, of Philadelphia. He recently assisted in the survey leading to the report on the elimination of waste in the building industry, which has just been published by the Federation. In making this announcement the Federation calls attention to the fact that it has just successfully rounded out its third year, having been established in 1918 as a War Service Committee of the War Industries Board.

New Haven, Conn.—Among the interesting results of a test made at Yale University on thirteen Yale students who were subjected to varying amounts of carbonic monoxide gas, was the discovery that the average person can inhale 10 parts of this gas in 10,000 parts of air for a period of two hours without any noticeable after effects, and anaemic persons and infants can safely breathe 3 parts in 10,000. The tests were conducted by the Bureau of Mines for the New York and New Jersey Bridge and Tunnel Commission, to determine the amount of exhaust gas from automobiles which can safely be present in the air of the proposed Hudson River vehicular tunnel. The gas was obtained from the exhaust of motor trucks and kept in glass tanks. The student undergoing the test was placed in an air-tight chamber into which a measured quantity of the gas was introduced. The student sat in a chair and read a paper or a book for two or 2½ hours. His blood pressure was then taken and compared with his condition before entering the chamber. Others who underwent the test were Professor Henderson of the bureau and Clifford M. Holland, chief engineer of the joint commissions, the former suffering no more serious effects than a severe headache.

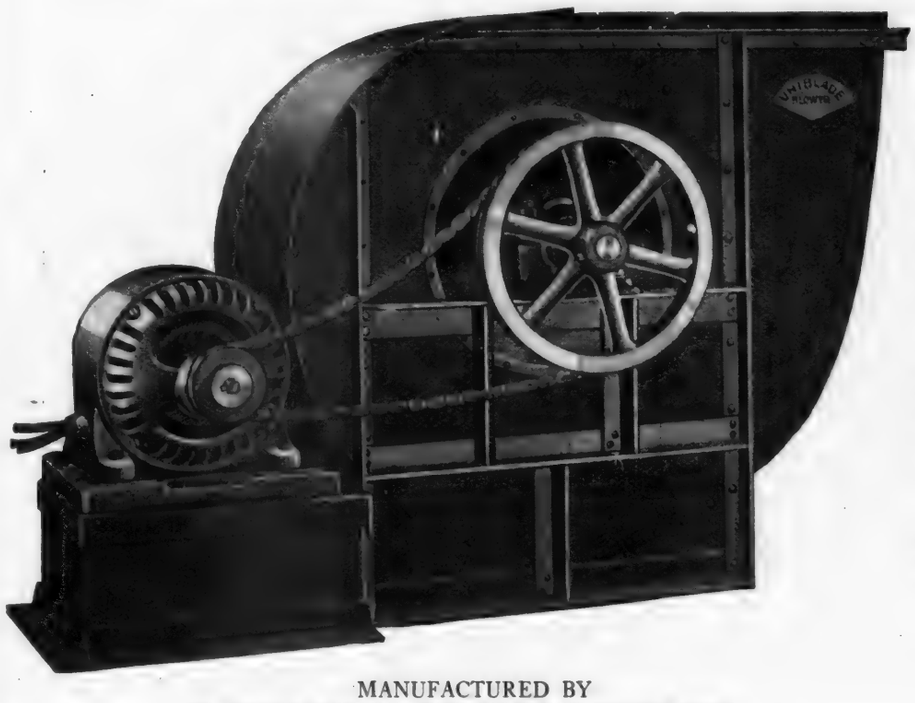
Chicago, Ill.—An amendment to the building code to exempt churches from the requirement for the installation of mechanical ventilating systems in public gathering places has been submitted to the city council by Alderman Thomas F. Byrne of the 29th Ward.

St. Louis, Ill.—The closing of a deal to furnish the steam heating for the Southern Hotel in Waterloo, Ill., by the East Side Heating & Power Company, of which Thomas T. Sullivan and John Riegert, of East St. Louis, are president and secretary, respectively, brought to light the fact that the union steam fitters, who had been in trouble with the employers for the previous year or so, had decided to embark in the contracting business.

Leavenworth, Kan.—The old incineration plant at Fort Leavenworth, which has not been used for some time past, is to be rebuilt and turned into a central heating plant for heating the barracks used by the cavalrymen and the buildings occupied by the non-commissioned officers.

Construction activity in July, according to figures published by the F. W. Dodge Company, was 7% less than in June, although it was 4% greater than in July, 1920. Contracts awarded during July in the 27 northeastern States amounted to $212,491,000. Residential building

UNIBLADE BLOWERS (CHAIN DRIVE)



UNIBLADE BLOWERS arranged for chain drive can be furnished in all sizes up to No. 10 inclusive.

UNIBLADE CHAIN DRIVEN BLOWERS are neat in appearance, compact in design and construction and efficient in operation.

On installations where it is not possible nor practical to install blowers or exhausters direct connected to motors, we strongly recommend the installation of UNIBLADE CHAIN DRIVEN BLOWERS.

We will consider it a privilege to give you further information and to quote on your requirements.

Write for bulletin No. 54

MANUFACTURED BY
BATTERMAN-TRUITT COMPANY
General Offices and Works: 730-38 W. Monroe St., Chicago, Ill.
Branch Offices in all Principal Cities

continued in the lead over all other classes in July, amounting to 28% of the total. Public works and utilities came to 22%, business buildings to 16%, educational buildings to 13% and industrial buildings to 6½%. In New England there was an increase of 28% over the June figure. In New York State and norther New Jersey, a decrease of 15% was reported. In the middle Atlantic States, the decrease was 18%. In the Pittsburgh district a decrease of 9% was reported, while a decrease of 5% was recorded in the central West. In the Northwest, however, there was an increase of 30% over the June figure.

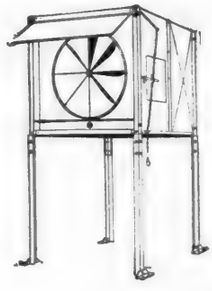
The Journal of Production is the title of a new management magazine, published under the direction of Leon P. Alford, formerly one of the technical editors of the *American Machinist* and, later, of *Industrial Management*. Mr. Alford is assisted by E. W. Tree, formerly associate editor of *Mechanical Engineering*. Each of the articles is indexed according to the Brussels classification of the Dewey decimal system and Harrison W. Craver, director of the Engineering Societies Library, presents a method by which this system can be utilized by the engineer in connection with his own library.

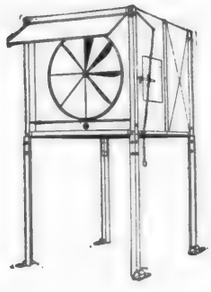
Toronto, Can.—As the result of a meeting of various branches of the building industry in Toronto intended to formulate definite action to stimulate building, a resolution was passed and endorsed by the labor representatives present, as follows:

"Moved that inasmuch as figures have been presented at this meeting to show that material costs are rapidly declining, that costs of living are also rapidly declining, and that a reduction in wage rates as suggested below can be put into effect without in any way lowering the present standard of living; Therefore be it resolved that the 19 representatives from the Building Trades Unions take back to their respective unions the suggestion that a voluntary reduction of ten cents per hour be put into effect on July 25."

New York.—In a statement prepared by the Industrial Bureau of the Merchants' Association of New York, it is shown that the construction industry of the United States represents a total wealth of about $77,000,000,000, or 26.8% of the entire wealth of the country. It is estimated

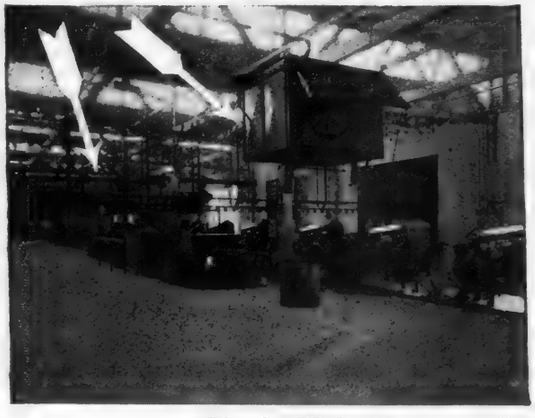
A PROFITABLE 24 HOUR HEATING CHART





ILGAIR UNIT HEATERS

Here is the conclusive answer to the Most Important Problem of Industrial America. A method of heating where the cost is measured by the hourly working schedule.



Ilgair Unit Heaters distribute heat at the floor where it belongs at a cost that represents considerable saving

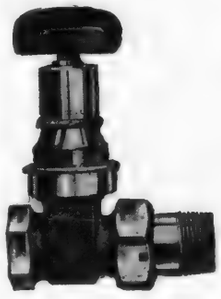
HEAT EFFECTIVELY IN WINTER AND COOL PLEASINGLY IN SUMMER

Send for Circular

ILG ELECTRIC VENTILATING CO., 2858 N. Crawford Ave., Chicago, Ill.

BRANCHES IN ALL LARGE CITIES.

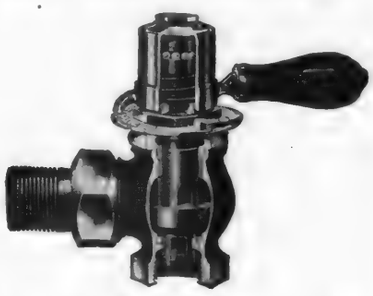
Dole



WE elected years ago to be the builders of the best radiator valves on the market. We have succeeded in our ambition. If any man desires to study the radiator valve field—he will become convinced of the fact that Dole Radiator Valves dominate their market.

A VALVE FOR EVERY SYSTEM

Write for catalogue and discounts



DOLE VALVE CO., Chicago, Ill.
1933 Carroll St.

REG. U.S. PAT. OFF. TRADE JENKINS MARK Jenkins Bros

Buy "signed" valves—with the Jenkins Diamond Mark and signature on the body.

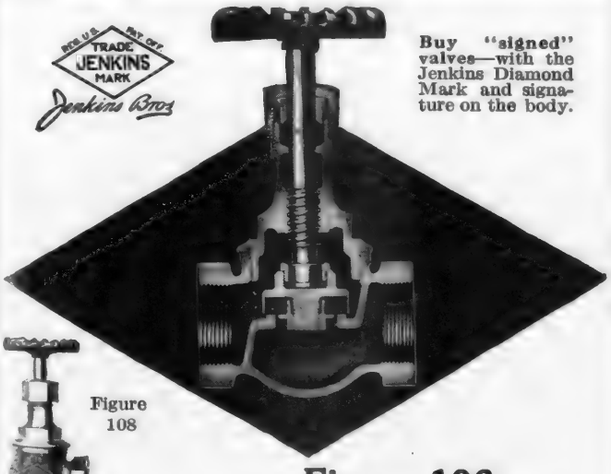


Figure 108

Figure 106

Figure 106

Jenkins Brass Globe Valve, standard pattern, for 150 pounds working steam pressure, or 250 pounds working water pressure. Fitted with Jenkins Renewable Disc, which gives valve practically unlimited life.

At all supply houses

JENKINS BROS.
New York Boston Philadelphia Chicago
Montreal London Havana
FACTORIES: Bridgeport, Conn.; Elizabeth, N. J.; Montreal, Canada

Jenkins Valves
SINCE 1864

When they go back to adjust the traps—Who pays?

YOU may have to pay the expense of adjusting radiator traps—unless you've used traps that you don't have to adjust.

That's one reason why so many plumbers and fitters are using and recommending Johns-Manville Radiator Trap.

Here's a trap that not only discharges water, but also air—it doesn't air bind—and there are no expanding members or parts that require adjustment.

For the only moving part in a Johns-Manville Radiator Trap is a hollow copper ball which floats unattached up and down with the water level in the trap.

When the water level drops, the ball drops; gradually rolling over the discharge orifice of the trap, thus throttling down the outflow and maintaining sufficient water in the trap to provide a water seal and prevent leakage of steam. When the water level raises the ball, the discharge orifice is exposed and the water is free to flow out of the trap.

JOHNS-MANVILLE, Inc.
Madison Ave. at 41st St., New York City
Branches in 64 Large Cities

For Canada:
CANADIAN JOHNS-MANVILLE CO., Ltd.
Toronto

Through—
Asbestos
and its allied products
JOHNS-MANVILLE
Serves in Conservation
Heat Insulations, High Temperature Cements, Asbestos Roofings, Packings, Brake Linings, Fire Prevention Products

JOHNS MANVILLE Radiator Trap

that 11,000,000 persons, either as workmen or as members of workers' families, derive their living directly or indirectly from this industry. Railroads are second in importance, and light and power stations, telephone and telegraph systems, canals and irrigation enterprises follow. The statement further calls attention to the fact that none of the recommendations of the United States Senate Calder Committee regarding special legislation in the matter of coal, transportation, direct direction of credit and taxation, have as yet been adopted by Congress.

Coal consumption according to principal uses is given as follows by the United States Geological Survey as a portion of its weekly coal report, dated July 23. It is pointed out that consumption is not the same as production. The table represents, in a general way, the conditions during 1917, a year of large consumption. (The figures for bituminous coal represent the calendar year 1917, and those for anthracite, the coal year ended March 31, 1917):

	Quantity Net tons.	P. C.
Bituminous coal:		
Industrial plants	174,600,000	31.7
Public utilities:		
Electric	31,700,000	5.8
Gas	4,960,000	0.9
Railroads	153,700,000	27.9
Domestic consumers	57,100,000	10.3
Power and heat at mines	12,100,000	2.2
Exports	22,900,000	4.1
Bunkers:		
Foreign trade	6,700,000	1.2
Coastwise and lake trade	3,600,000	0.7
Beehive coke	52,240,000	9.5
By-product coke	31,500,000	5.7
	551,100,000	100.0
Anthracite:		
Domestic consumers (domestic sizes)	49,400,000	55.1
Artificial gas plants	1,650,000	1.8
Steam trade industries (industries, power plants, and heating of large buildings)	18,450,000	20.5
Railroad fuel	6,400,000	7.1
Power and heat at mines	9,350,000	10.4
Exports	4,600,000	5.1
	89,850,000	100.0
Grand total	640,950,000	

Indianapolis, Ind.—Manufacturers of heating appliances and distributors in Indianapolis are expected to take a prominent part in the Indianapo'is Industrial Exposition, to be held October 10-15, at the Indiana State Fair Grounds, under the auspices of the Indianapolis Chamber of Commerce. One of the unique features of the exposition will be the reproduction in miniature of the retail district of Indianapolis in the Manufacturers Building, with the world-famed Soldiers' and Sailors' monument in the center of the network of streets.

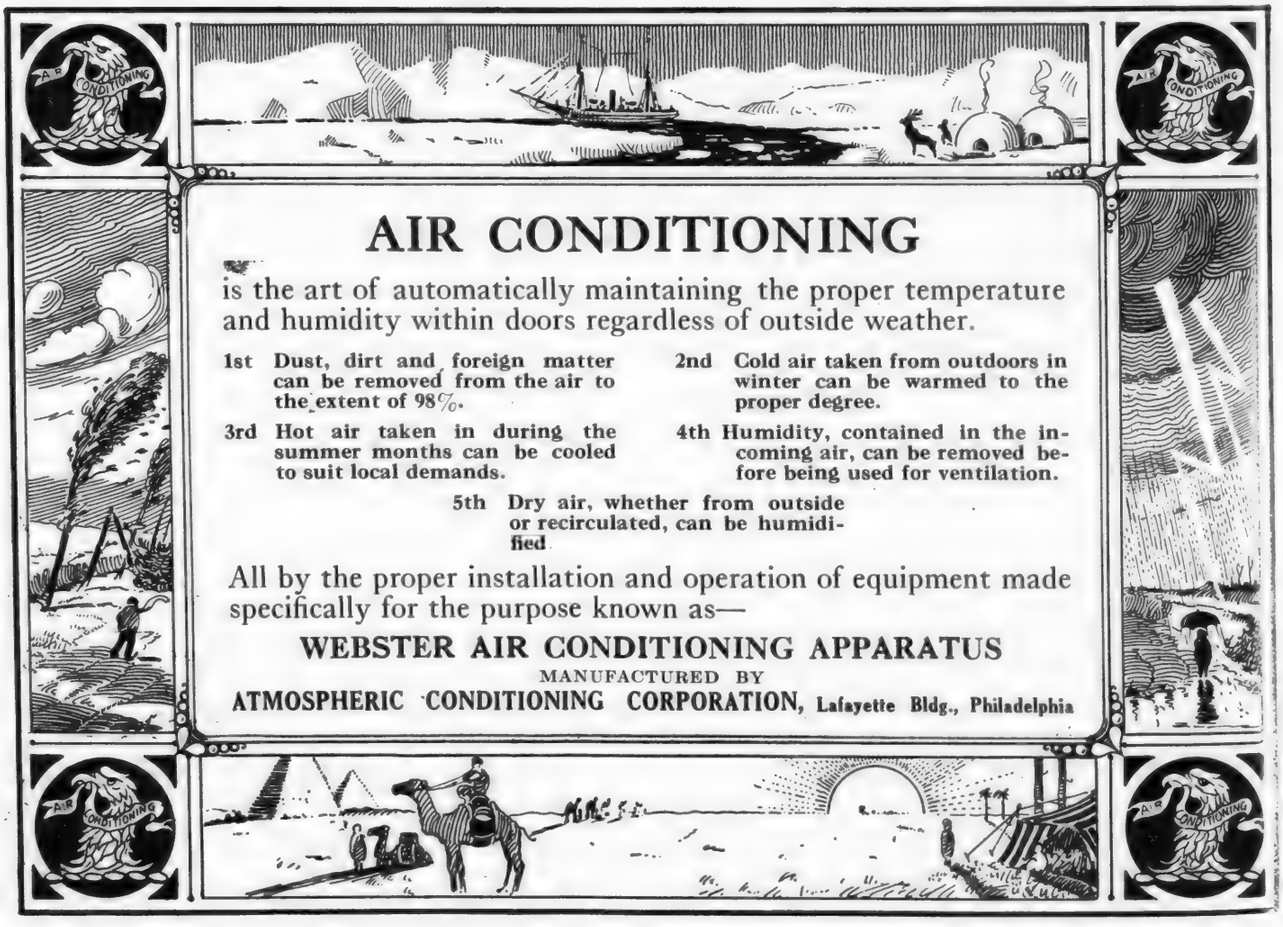
New York.—Recent reports on the coal market in New York, published by the New York Building Superintendents' Association, characterize the market as stagnant, with the prices weak. The price of bituminous steam coal, mine run at Pittsburgh is quoted as low as $1.50 per ton, which compares with the average 1913 price of $1.27. Higher prices are predicted in the report.

Manufacturers' Notes.

Trane Co., La Crosse, Wis., manufacture of the Trane system of vapor heating and other heating specialties, announces the establishment of new branch selling connections in Cleveland and Buffalo, as follows: H. Porter, 5601 Euclid Ave., Rear, Cleveland, and the John R. Moore Co., 256 Main St., Buffalo.

Kewanee Boiler Co., Kewanee, Ill., announces the opening of a Philadelphia branch at 510 Real Estate Trust Building, Broad and Chestnut Streets. The branch is in charge of H. B. Hedges and B. A. Porter, both of whom are experienced mechanical and sales engineers. The branch covers the territory of New Jersey, south of Trenton; Pennsylvania, east of Altoona; and Delaware.

Walworth Mfg. Co., Boston, Mass., has moved its general offices to Pearl and



AIR CONDITIONING

is the art of automatically maintaining the proper temperature and humidity within doors regardless of outside weather.

1st Dust, dirt and foreign matter can be removed from the air to the extent of 98%.

2nd Cold air taken from outdoors in winter can be warmed to the proper degree.

3rd Hot air taken in during the summer months can be cooled to suit local demands.

4th Humidity, contained in the incoming air, can be removed before being used for ventilation.

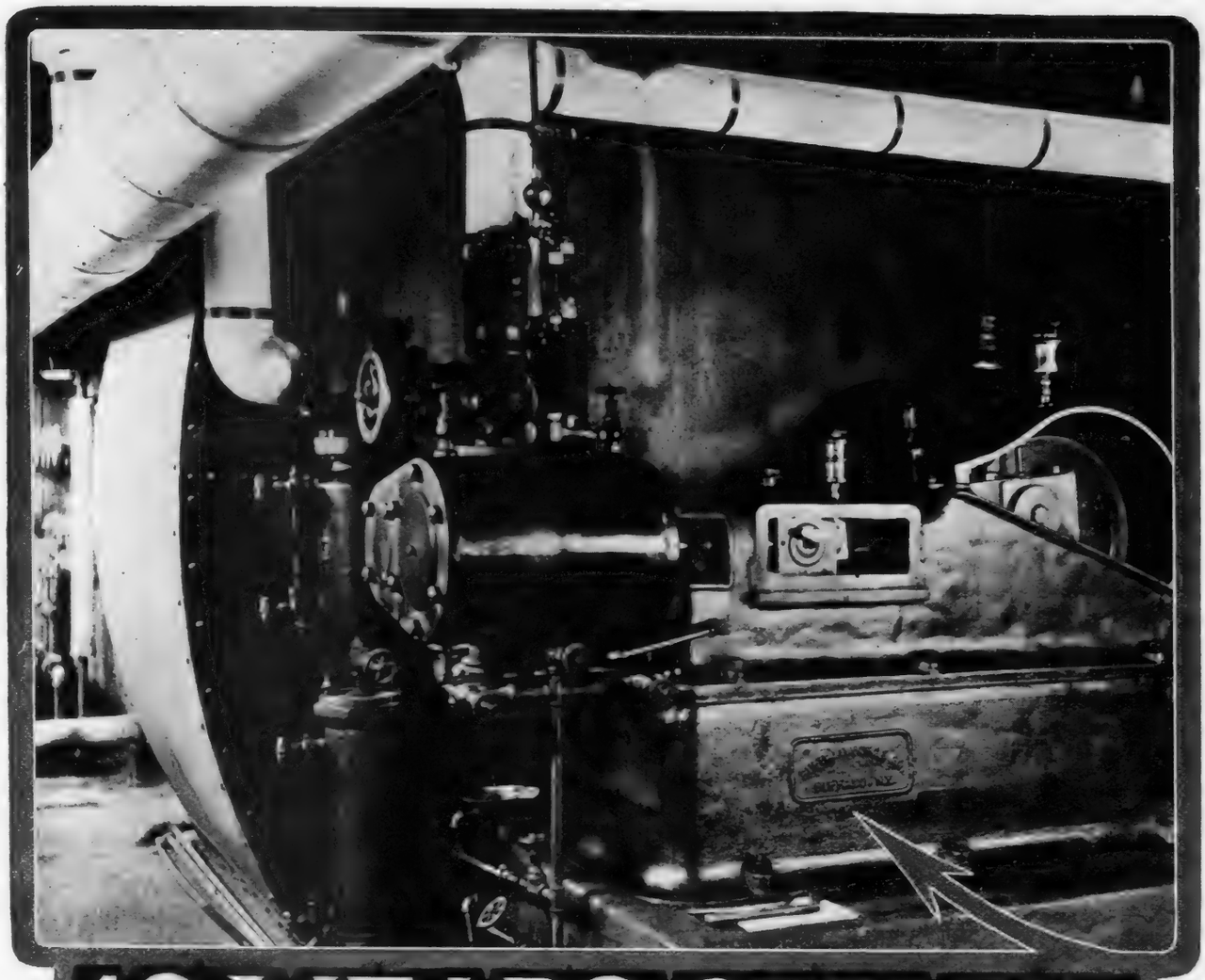
5th Dry air, whether from outside or recirculated, can be humidified.

All by the proper installation and operation of equipment made specifically for the purpose known as—

WEBSTER AIR CONDITIONING APPARATUS

MANUFACTURED BY

ATMOSPHERIC CONDITIONING CORPORATION, Lafayette Bldg., Philadelphia



19 YEARS SERVICE

The drying of crayons is one that calls for the highest efficiency of the mechanical equipment.

The American Crayon Company have kept the "Old Faithful" brand of crayons and chalks at the front of the field since 1835.

We point with pride to the Buffalo Fan and Engine that has typified "Old Faithful" by its nineteen years of continuous and satisfactory service at the American Crayon Company. This is summed up by a recent report which states

"We like it because it gives good service"

A line to Dept. 36 will bring further evidences of Buffalo Service.

"Buffalo"

High Sts., Boston. The new quarters embrace an entire block on High Street.

Burnett Heating System Co., Rice Lake, Wis., recently incorporated with a capital stock of $100,000, to manufacture heaters for farms and rural communities, will build a foundry and machine shop on an 80-acre site which the company has recently acquired on the Chicago and Northwestern and Soo Line tracks.

Yeomans Bros. Co., Chicago, Ill., manufacturer of centrifugal sewage ejectors, Shone pneumatic sewage ejectors and drainage pumps, announces the appointment of the following new representatives: P. E. Fallon, Gazette Building, Little Rock, Ark., and Morton, McI, Dukehart & Co., McComas and Race Sts., Baltimore, Md.

Crane Co., Chicago, Ill., is building a pipe and pipe-bending shop in Pittsburgh at 35th Street and the Allegheny Valley Railroad. A warehouse will also be built, adjoining the pipe shop. The cost will be about $800,000.

Ohio Pipe Bending & Machine Co., Cleveland, has moved to 2010-20 Elm Street, in the same city.

Sloan Valve Co., Chicago, Ill., has opened a Canadian branch in Toronto, under the name of the Sloan Valve Co., Ltd, The Canadian company will manufacture and distribute the company's products in Canada. C. E. Sloan is manager and the factory, warehouse and offices are located at 67 Adelaide St., East, Toronto.

Illinois Pipe & Mfg. Co., Chicago, Ill., has removed its plant to 3465 South Lawndale Avenue. The company was formerly located on South Jefferson Street.

Central Station Heating Notes.

Manhattan, Kan.—A central heating plant is under discussion for Manhattan, the proposition having grown out of the proposed sale of the central heating plant of the Camp Funston Zone, which was to be offered at public auction August 16-19. The matter has been discussed by the local Chamber of Commerce.

Webster City, Ia.—The Central Heating Company plant in Webster City, which recently went into the hands of a receiver, will be operated during the coming winter by the business men whose buildings it heats, under an order handed down by Judge G. D. Thompson. R. P. Smock, receiver for the company, was instrumental in bringing about the present arrangement, after finding that it would be impossible for the company to furnish heat. Under an agreement between the consumers and the company the former will make all necessary repairs and govern the operation of the plant through a board of directors appointed by them. The company is to get no rent or compensation other than the sums expended in putting the plant in order.

Springfield, Ill.—The referendum election on the propositon of having the city of Springfield purchase the light and heating plants of the local utilities company, resulted in a decision not to effect such purchase. Instead, the commission's plan was adopted, which is to develop the city light plant. Bonds for this purpose to the amount of $400,000 are to be issued. After many months of negotiation the utilities agitation had simmered down to a question of whether the Springfield Gas and Electric Company would furnish heat, light and power to the city or the municipal plant be given that privilege. The immediate question was whether the city should pay the $2,108,212 valuation set upon the private concern's holdings and whether the Citizens' Electric Company should be incorporated to take over the Springfield company's holdings until such time as the city had completed its purchase payments. The Springfield Gas and Electric Company, which furnished three-fourths of the city's power and steam heat, lost its franchise by expiration on the Monday previous to the election, the election being held August 16.

Kokomo, Ind.—The local Chamber of Commerce has appointed a committee composed of J. E. Fredrick, W. W. Coles and O. M. Booher, to investigate the rates charged by the I. R. & L. Company. The committee will visit other localities.

Belvidere, Ill.—The Belvidere Heating Company is again taking up the project of putting through the central heating plant plans and completing the system. Following a recent survey of the plant as it stands, made by J. C. Hornung, of Chicago, it was estimated that the work can be completed at an additional invest-

LEHIGH

Fans
Air Washers
Dust Collectors
Mushroom Ventilators
Roof Ventilators
Unit Heaters

HERSH BROTHERS CO.
655 Mill Street
ALLENTOWN, PENNA.

"Sirocco"
TRADE MARK

Clean, Conditioned Air

For Industrial Plants

IN many industries the biggest factor to economical production is cleaned, conditioned air. A chocolate candy plant is one example. The air must be just right for the proper handling of the candy, otherwise production slumps, losses mount.

AN "A B C" AIR WASHING AND COOLING FAN is making possible cleaned, conditioned air in hundreds of industries today.

This fan can be installed at comparatively small expense, is economical of room and cleans the air in a thoroughly satisfactory manner.

Heating and ventilating contractors are invited to write us for detailed information on this "A B C" Air Washing and Cooling Fan.

AMERICAN BLOWER COMPANY
DETROIT, MICH.

Special Advantages of the "A B C" Air Washing and Cooling Fan.

1—*Purifies* the air by removing all solid particles.

2—*Humidifies* the air by accelerating evaporation of circulating water.

3—*Cools* the air because the process of evaporation withdraws heat.

PACKING ROOM OF THE CRANE CHOCOLATE CO. CLEVELAND, O.

"Sirocco" Air Washer-Fan Unit Installation maintains the low temperature of purified air required for the handling of fine confections in this plant.

ment of $20,000. This sum is needed to finish the system to Whitney Street and First Street and to put the heating plant in shape to furnish heat during the coming season. At a recent meeting of the directors of the company, Mr. Hornung presented a number of recommendations for reducing the cost of further construction and for permitting the extension of the plant beyond the business districts.

New York.—The New York Steam Corporation has been organized to take over the properties, franchises and business of the New York Steam Company which has been in the hands of receivers. The entire property was sold at foreclosure sale this summer to Moses, Pope & Trainer, Inc., an engineering firm. James D. Hurd is president of the new company, having resigned as assistant secretary of the Guaranty Trust Company to take the new post. George Hubbell, Jr., is treasurer. The directors are: James D. Hurd, Frederick Pope, George L. Hubbell, Jr., G. R. Gotrell, G. F. Hurd, G. C. St. Johns and Philip Russell.

The new company has been authorized to issue 20,000 shares of no par common stock, $400,000 in mortgages of its real estate, and $2,300,000 in 8% general mortgage bonds. The bonded indebtedness is limited to $2,700,000. The new company's certificate of incorporation, however, gives its capital as only $25,000. Therefore, the Public Service Cammission has ordered an immediate appraisal, in order to open the books on a basis "found on its true capital." The 8% general mortgage bonds are to be brought out by the Guaranty Trust Company as trustee, with provisions for a sinking fund.

New Corporations.

Galesburg, Ill.—Domestic Heating & Lighting Co., Galesburg, Ill., incorporated by A. E. Caldwell and C. E. Caldwell, both of whom were engaged in aviation work in Galesburg until fire destroyed their plant, airoplanes and equipment last January. The new company has taken quarters at 63 East Simmons St., and will handle a number of heating specialties, including the Nokol oil-heating device.

Breeze & Bettle, Inc., Chicago, Ill., capital $20,000, to manufacture and deal in heaters, furnaces, boilers and heating devices. Offices have been opened at 112 West Adams St.

Wales Co., Kalamazoo, Mich. capital 200,000 shares of no par value common stock, to manufacture and sell automatic heaters designed and perfected by Mr. Wales for use, with gas as a fuel, in connection with warm air, hot water and steam systems. President, S. D. Monroe; vice-president, N. B. Wales; secretary, Harry Snow; treasurer, T. E. Mulhall. Directors: the officers named and A. E. Curtenius, C. A. Blaney, E. M. Sargent and A. J. Patterson. Manufacturing, it is stated, will begin immediately.

Moore Patents Corporation, New York, capital $500,000, to manufacture pipe, pipe fittings, plumbing fixtures, etc., Incorporators: G. W. Moore, S. Dressler, and A. Berres. The company is represented by H. G. Littau, 391 East 149th St., New York.

Acme Boiler Works, Inc., Detroit, Mich., capital $25,000, to manufacture boilers, tanks, etc., Incorporators: Charles L. Simmons and Samuel A. Reigel.

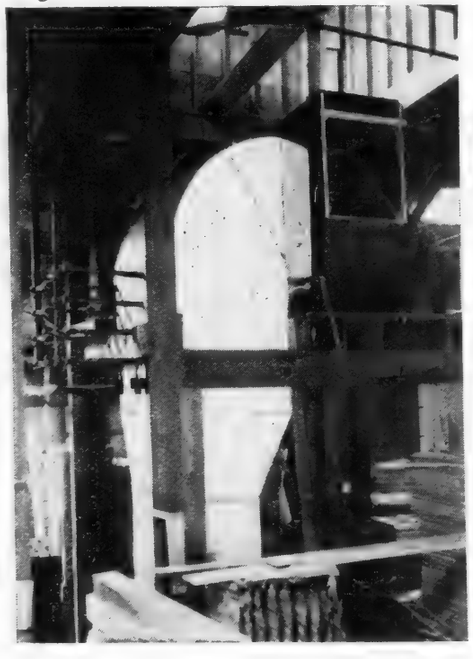
Automatic Heating Corporation, Boston, Mass., capital $200,000, to manufacture heating equipment. Incorporators: Eugene T. Vincent and William H. Kraus, Boston, and James H. Campbell, Cambridge.

Safety Gas Apparatus Co., Inc., Hoboken, N. J., capital $100,000, to manufacture gas-burning equipment. Incorporators: William Wirt, William J. Connolly and Paul Devarco.

Spencer Thermostat Co., Boston, Mass., capital $25,000, to manufacture heat regulators. Incorporators: Laurence K. Marshall, West Somerville; John A. Spencer, Cambridge; and F. Wilder Pollard, Boston.

Ross Valve & Mfg. Co., Detroit, Mich., capital $20,000, to manufacture valves and other specialties. Incorporators: C. C. Ross, C. C. Rosser and S. J. Cameron.

Zolleis Mfg. Co., East Orange, N. J., capital $100,000, to manufacture valves and other appliances. The company is represented by Harry H. Picking, 525 Main Street.



HACKNEY "V" BLADE BLOWER
Installed with indirect heating plant

BLOWERS!?

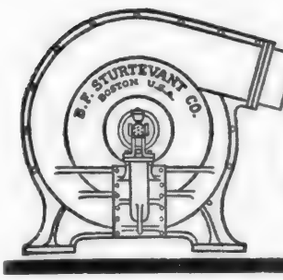
HACKNEY "V" BLADE BLOWERS

Solid "V" Blade Construction
Long Life
Maximum Service
Minimum Cost

Write for our catalog and data book

Sales agents wanted in all territories

HACKNEY MANUFACTURING CO.
ST. PAUL, MINN.
Manufacturers of Blowers and Ventilating Equipment



Sturtevant

REG. U.S. PAT. OFF.

PUTS AIR TO WORK

Exact Knowledge vs. Experiment

HEATING and ventilation in schoolhouses are of fundamental importance; choice of a system should be based only on proved performance. The operation of Sturtevant apparatus is a known quantity—determined by installations throughout the country.

Schools will be prominent among construction projects this year. Need for them is immediate and the time for the preparation of plans and investigation of mechanical installation will be limited. Sturtevant service and experience can greatly assist the engineer under these conditions. Our knowledge of schoolhouse requirements and long record of successful installations give the engineer assurance of suitability to conditions, economy of installation and efficiency in operation. Qualified Engineers at any of our offices are ready to consult with you.

The Portland High School, at Portland, Me., illustrated above, was designed by Miller & Mayo, Architects; R. D. Kimball Co., Heating Engineers. Heating and ventilating supplied by Sturtevant Equipment.

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASS.

STURTEVANT BRANCH OFFICES

ATLANTA, GA. 306 Walton Bldg.
BOSTON, MASS. 555 Mass. Trust Bldg.
BUFFALO, N. Y. 100 Bedford Ave.
CHICAGO, ILL. 530 So. Clinton St.
CINCINNATI, OHIO 604 Provident Bank Bldg.
CLEVELAND, OHIO 330 Guardian Bldg.
DALLAS, TEXAS 3411 Knight St.
DETROIT, MICH. 406 Marquette Bldg.
HARTFORD, CONN. 36 Pearl St.
KANSAS CITY, MO. 3830 Park Ave.
LOS ANGELES, CALIF. 411 Hollingsworth Bldg.
MINNEAPOLIS, MINN 804 Met. Life Bldg.
NEW YORK, N. Y. 52 Vanderbilt Ave.
PHILADELPHIA, PA. 135 No. Third St.
PITTSBURGH, PA. 711 Park Bldg.
ROCHESTER, N. Y. 1024 Granite Bldg.
ST. LOUIS, MO. 2086 R'y Exchange Bldg.
SALT LAKE CITY, UTAH 818 McIntyre Bldg.
SAN FRANCISCO, CALIF 759 Monadnock Bldg.
SEATTLE, WASH. 1105-1106 White Bldg.
WASHINGTON, D. C. 1006 Loan & Trust Bldg.
B. F. STURTEVANT CO. OF CANADA, LTD. GALT, ONT.
MONTREAL 404 New Birks Bldg
TORONTO 210 Lumsden Bldg.

Contracts Awarded.

Downey Heating & Supply Co., Milwaukee, Wis., heating the Washington School in Racine, Wis., for $45,674. This figure is $21,000 lower than the lowest bid received for the same work last March.

J. R. Sheehan Co., Schenectady, N. Y., heating new High School in Oswego, N. Y., for $65,537.

E. J. Bates Co., Syracuse, N. Y., heating new State Normal School in Cortland for $103,358.

New Firms and Business Changes.

Vesuvius Engineering Co., New York, has removed its offices from the Grand Central Palace to 505 Fifth Avenue.

Ammerman & McColl, consulting engineers, Detroit, Mich., announce the addition to the firm of Jay Willard Snyder and Dermid McLean, who, for many years, have been actively identified with the organization. The new firm will be known as McColl, Snyder and McLean. The head of the firm, Jay R. McColl, is well-known to heating engineers, being at present vice-president of the American Society of Heating and Ventilating Engineers. The company will conduct a general engineering business, specializing in power plant work and heating and ventilation.

FOR SALE

30 new sets No. 2 Toledo Stocks and Dies at $37.00 per set complete. Threads pipe 2½ in. to 4 in. Box 150, Granite City, Illinois.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

WANTED

Estimator and Superintendent for heating and ventilating work. One capable of designing Hot Water and Steam Heating plans. State full particulars, salary, experience, etc. Box 150, Granite City Illinois.

VACANCY.

A rapidly growing concern of heating and power engineers and contractors, handling large contracts, have an opening in their organization for a competent heating engineer who is an expert in handling mechanics, estimating labor, and who can complete the work within the estimated amount.

For a man who can produce results, and can qualify to take entire charge of construction and installation, there is an unusual opportunity to become manager of this division of the business. But exceptional qualities are necessary and only a high caliber executive and engineer could fill the position. Salary to start, $5000. Address Box "G," care of HEATING AND VENTILATING MAGAZINE.

WANTED
Heating and Ventilating Salesmen

If you can qualify as a good salesman for our Products, we have an excellent opportunity for you. Have you an acquaintance with architects, engineers, and contractors—have you sold heating and ventilating systems? If so, you can capitalize your acquaintance and experience. We have a proposition that is equivalent to putting you in business for yourself.

Moline Heat salesmen who have been operating for years, will furnish sufficient evidence of the possibilities. You need not be a technical engineer, so long as you know the fundamentals of good heating and ventilating and are a good salesman.

The Univent is now becoming recognized by leading Architects and Engineers as the greatest step in modern ventilation. It is now being specified for schools and public buildings from Maine to California.

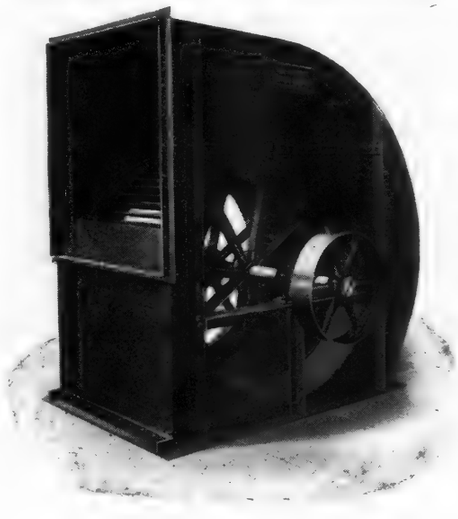
Also manufacturers of the well-known Moline System of Steam Circulation on the market for the past fourteen years and in many parts of the country is well known and widely used by leading Architects and Contractors; also manufacturers of other products identified by heating and ventilating. See our advertisement on page 15.

Write at once as territory is fast closing up.

MOLINE HEAT
Moline, Illinois

Buckeye Multiblade Fans

are made especially for low pressure Heating and Ventilating work. They are giving perfect satisfaction.



CORRECT DESIGN, HEAVY CONSTRUCTION, NOISELESS OPERATION, WORKMANLIKE FINISH, HIGHEST EFFICIENCY.

Our Engineering Department is maintained for the purpose of assisting Engineers, Architects, etc., in planning efficient Heating and Ventilating Systems for all buildings.

THIS DEPARTMENT IS FREE TO YOU

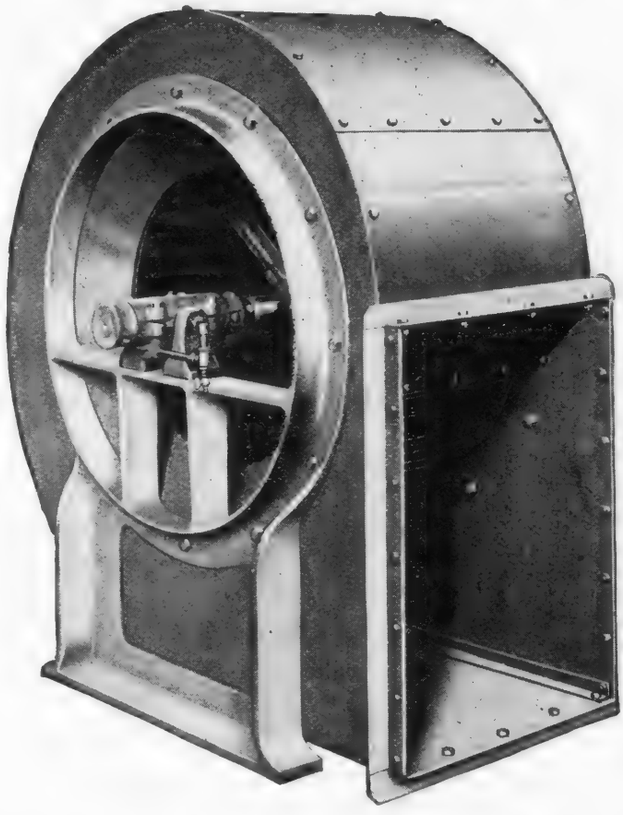
We also manufacture a complete line of Disc, Cone and Steel Plate Fans:

Write Department D

BUCKEYE BLOWER CO.
COLUMBUS, OHIO

The New York Blower Company

SERI-VANE FANS



Cut shows our standard type "C" Seri-Vane Fan as made in all sizes to and including number six—wheel diameter 36 inches. You will note fan is reversible as to both hand and discharge. Any special angular discharge can be readily attained with a minimum of labor. We stock all sizes of these fans so can ship any hand or discharge within twenty four hours from receipt of order at our factory.

Are you using our Mushroom Ventilators? If not, write for prices and literature and save labor of your men and your money.

THE NEW YORK BLOWER COMPANY

513 Transportation Building

CHICAGO, ILL.

Factory: Laporte, Ind.

For prompt service, write nearest sales office

THE DOUGLASS HUMIDIFIER

Is attached directly to the steam heating system

DISCHARGES DRY STEAM NOISELESSLY

Gives satisfactory results in any type of building equipped with steam.

Inexpensive to install

Will not get out of order

No attention required

No maintenance expense

Made in various sizes and types to suit all conditions and requirements.

May be installed in the plenum chamber of a ventilating system.

Operates perfectly with or without automatic control.

Illustrated catalogue sent on request.

THOMAS J. DOUGLASS & CO.,
441 N. Dearborn St.,
Chicago, Ill.

More in Your Favor

—with

Mel-Rock Air Washers

MEL-ROCK Air Washers possess many exclusive points of advantage, which are of high value. For instance:

EACH CAPACITY is made in from four to seven different proportions, so that any space and head-room may be accommodated.

MEL-ROCK Eliminator Systems are made in batteries, riveted at the factory. This saves you considerable time and money in setting up.

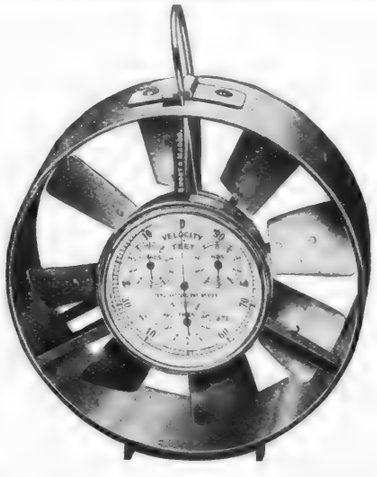
MEL-ROCK Mist Nozzles discharge a greater volume of mist, at low pressure.

MEL-ROCK stands for the very highest development in air-washing efficiency and economy.

Send for descriptive catalog.

TO AGENTS—There is still some good, exclusive territory open. Write for particulars.

MELLISH-HAYWARD COMPANY
213 West Austin
CHICAGO



Once the necessary velocity of air currents for heating and ventilating efficiency has been determined, a

Tycos Anemometer

demonstrates its worth by its accuracy, and ease of application. Measures the air in velocities of 100 to 3000 ft. per minute and is a practical instrument for determining the amount of air in the various workings.

A Sturdy, Dependable and Handy Instrument

Taylor Instrument Companies
ROCHESTER, N. Y.
There's a *Tycos* or *Taylor* Temperature Instrument for every purpose
804

Westinghouse
Ventilating Equipment
in the
INDUSTRIAL PLANT

W
WESTINGHOUSE ELECTRIC

Westinghouse engineers have specialized in the design of high grade equipment for ventilating work.

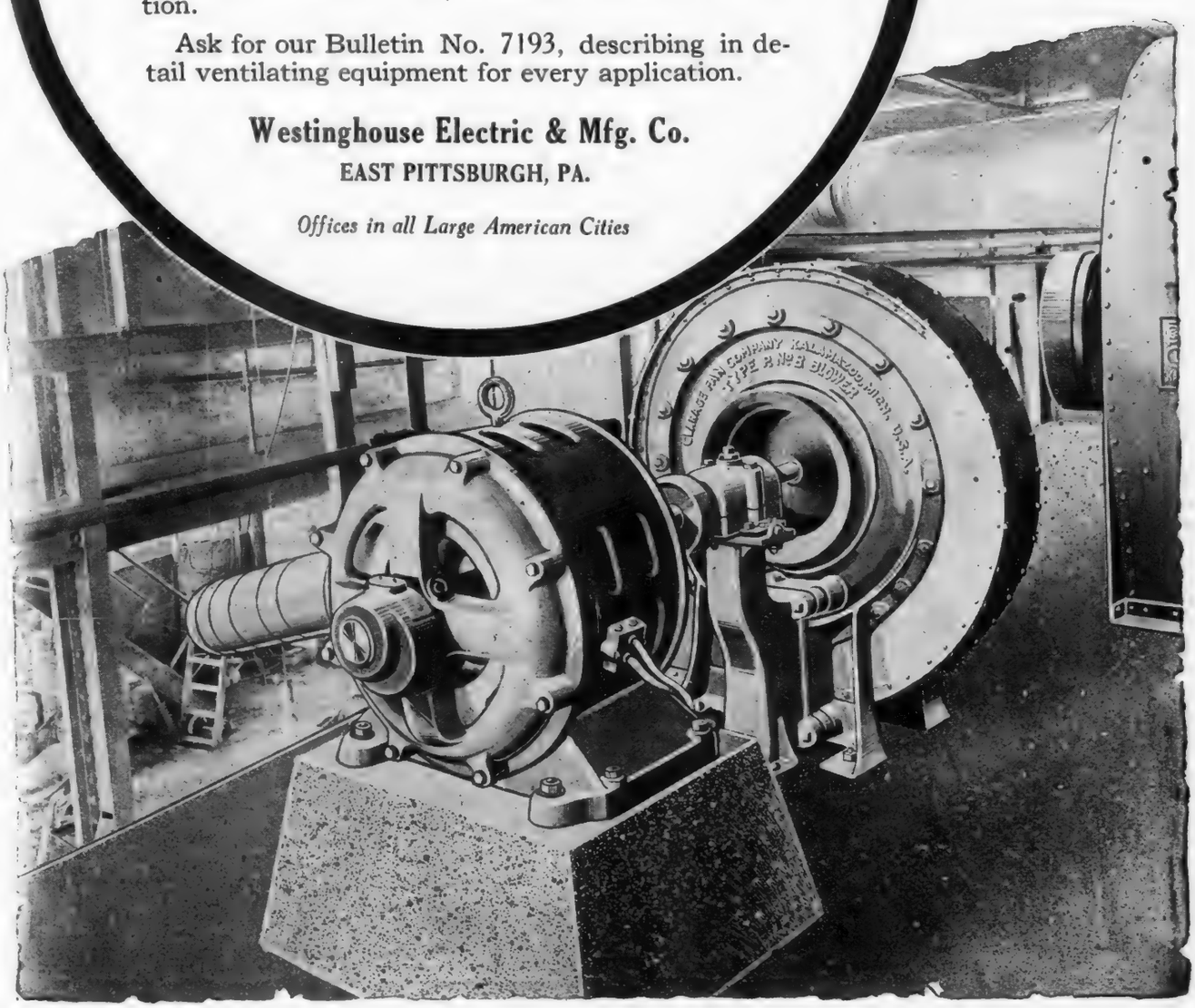
Motors and controllers have been designed for ventilating service in factory, home or school.

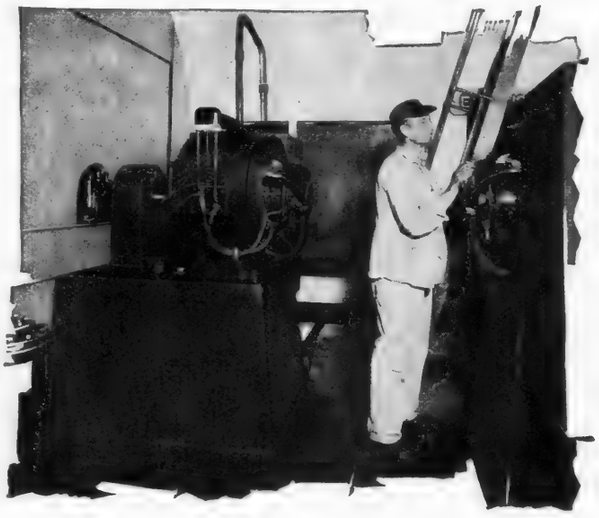
Big hotels, such as the Pennsylvania, in New York and many factories and schools all over the country, are using this equipment and running it continuously day and night with practically no care or attention.

Ask for our Bulletin No. 7193, describing in detail ventilating equipment for every application.

Westinghouse Electric & Mfg. Co.
EAST PITTSBURGH, PA.

Offices in all Large American Cities





Sprague Motor driving ventilating equipment, Lord & Taylor Building, N. Y. City.

SPRAGUE MOTORS

For Dependability

Far down below the gay counters and rustling throngs of Lord & Taylor's Fifth Avenue store, Sprague motors steadily run the big ventilating system that maintains the delightful, even, temperature of the store.

Institutions like Lord & Taylor do not choose their ventilating equipments at random; the question of dependability is always paramount.

Sprague motors have a distinct reputation for dependability.

SPRAGUE ELECTRIC WORKS
Of General Electric Company
PIONEERS OF THE INDUSTRY
Main Offices 527 W. 34th St. New York
Branch Offices in Principal Cities

St. Paul Athletic Club
St. Paul, Minn.

Equipped throughout with batteries of Massachusetts Fans.

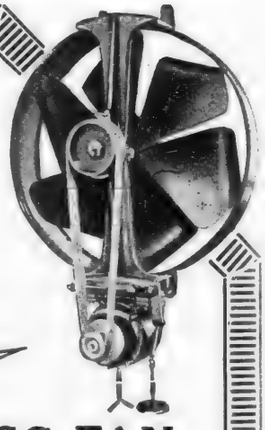
Massachusetts
Modified "Squirrel Cage" Fans

combine exceptionally high operating efficiency with a ruggedness and durability of construction that reduces both the operating and upkeep expense to a minimum. Each installation is "tailor-made" for the individual building, and is personally inspected and supervised for a greater or less period of time after installation, to assure maximum efficiency.

Massachusetts Blower Co.
Watertown, Mass.

FRESH AIR

is as essential to the efficiency of your working force as modern tools or office equipment. The



Bayley

JUNIOR DISC FAN

supplies a constant volume of pure, fresh air to your workrooms, removes foul air, smoke, noxious fumes and keeps your working force at its highest and most productive pitch.

It is made in sizes from 20 to 48" either for line shaft drive, or with variable speed motor drive. The patented, adjustable belt-tension speed regulating device permits the use of a standard, constant speed motor, yet allows a speed variation of from 2½ to 100% of full speed.

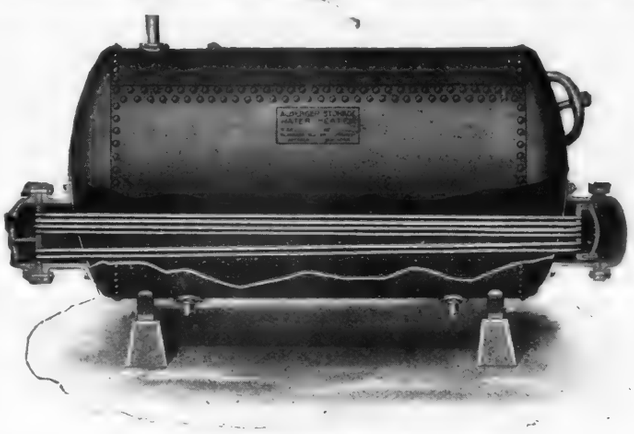
Send for Bulletin Today

BAYLEY MFG. CO.
Dept. E. MILWAUKEE, WIS.

Alberger Storage Water Heater

The Alberger Storage Water Heater consists of a steel shell fitted with straight seamless drawn copper tubes, arranged so that the stream passes through the tubes and the water is circulated around the tubes. Many of the advantageous features of the "Alberger Multi-Head" design, are embodied in the Storage Water Heater.

The floating head is contained in a tank flange at the back of the heater, resting on two angle iron guides, which run the full length of the tank and serve as supports for the floating head in case the heating element is to be withdrawn from the heater.



ALBERGER STORAGE WATER HEATER

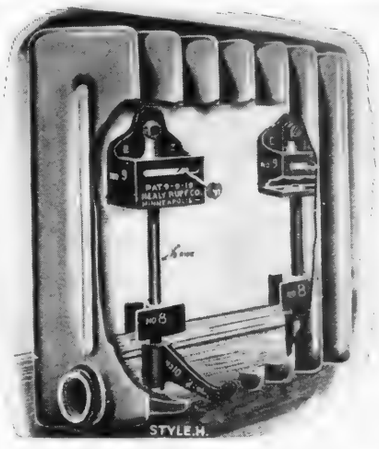
FEATURES

Accessibility for cleaning and repairs.
High rate of heat transmission.
Heating element interchangeable.
Tubes pitched to drain freely.

Write for Catalogue No. 3

Alberger Heater Company

BUFFALO, N. Y.



EZ

Radiator Hanger

Write for Bulletin

BASE BOARD ADJUSTMENT
HORIZONTAL "
VERTICAL "

ONE BOLT IN THE WALL

Both styles made for Wall and Column Radiation.

Very Reasonable in Price.

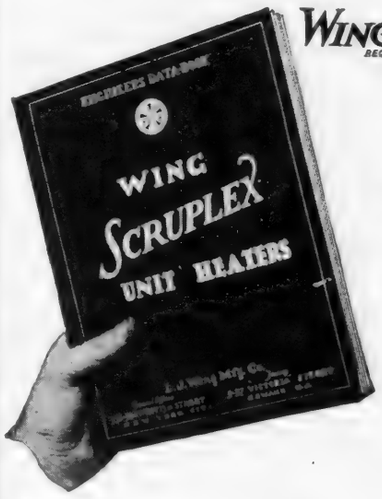
Agents in a good many Cities

Style R

HEALY-RUFF CO.

MINNEAPOLIS, MINN.

Get This New Book on Unit Heaters



WING-SCRUPLEX
REG. U.S. PAT. OFF.

UNIT HEATERS

Present the best method of heating any mill, factory, foundry, garage, etc. They confine the heat to the working area where it is needed, thereby effecting a substantial saving in coal consumption. For such buildings, cost of installation is lower than ony other heating system.

Built in Several Sizes, in Three Different Types: Floor, Ceiling and Wall Types.

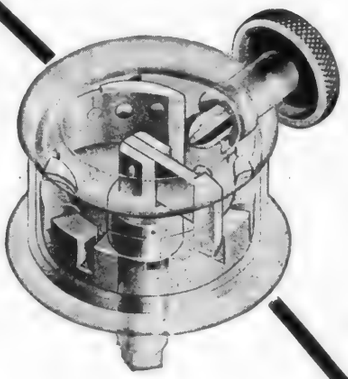
L. J. Wing Mfg. Co.

Fans and Blowers (all types)
Damper Regulators Small Turbines

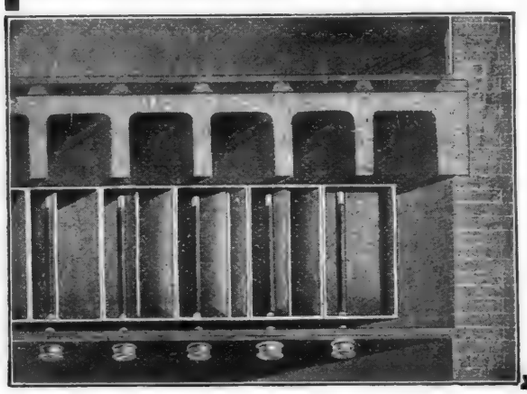
H UDSON and 13th STREETS, NEW YORK CITY

Allow us to introduce to you —

THE PERFECTO DAMPER REGULATOR AND INDICATOR



This device, when placed on a battery of ducts in the collecting chamber near the machinery room, not only affords an easy and convenient means of regulating the flow of air, but also serves as a positive means of indicating the room to which each duct leads, by means of the numbered or lettered cover windows.

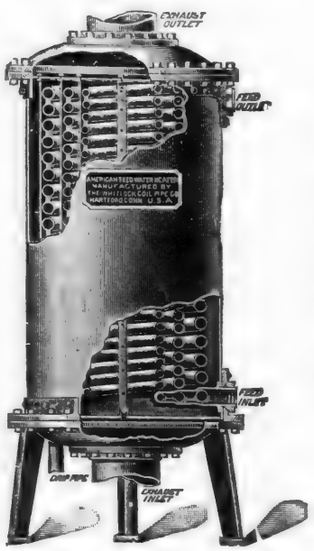


This is the Key to Good Ventilation

Let us send you further particulars

The Sixth City Sheet Metal Works Company

Cleveland, Ohio
Office and factory, 1830 St. Clair Avenue



WHITLOCK
Copper Coil Instantaneous Heaters

The Whitlock Type AC Heater (illustrated) is particularly adapted to duties where water must be heated nearly to the steam temperature. Designed for this purpose, there is a long travel, through helically coiled tubes, which breaks up the "stream lines" and brings every particle of water into direct contact with the copper heating surface.

Whitlock Type AC Heaters are furnished in sizes to heat from 50 to 9000 gals. per hour. Heaters up to 5000 gals. capacity, in stock at Hartford, can be shipped usually on receipt of order.

Bulletin 24 which describes this heater in full detail sent upon request

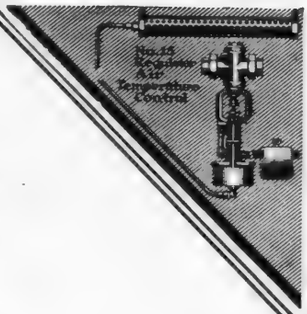
SEE OUR CATALOGUE IN SWEETS

THE WHITLOCK COIL PIPE COMPANY, HARTFORD, CONN.

New York **Philadelphia** **Boston** **Buffalo** **Chicago**

NOTE: The Whitlock Coil Pipe Company announces that it has acquired by purchase the drawings, patterns, good-will, etc., of that department of the Pratt & Cady Company of Hartford, Connecticut, which formerly conducted the feed water heater and hot water service heater business originated by I. B. Davis & Son, and has added to its line these types of heaters, and is prepared to furnish complete units or parts thereof.

PREPARE NOW

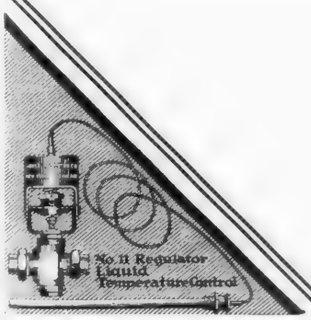


Now is the time to prepare for proper heat control this winter. Don't wait until the last minute and then put in the first regulator you see. Look the field over and learn the many points of superiority of

The Powers Heat Regulator

Proper control of heat is only effected by scientific, automatic machines. POWERS regulation, built on scientific basic principles, and being entirely automatic and dependable, assures you not only of proper but also of economical heat control.

Learn more of the Powers Regulation
Write today for our Bulletin No. 138
Put any heating problem up to us
Our Research Department is at your service



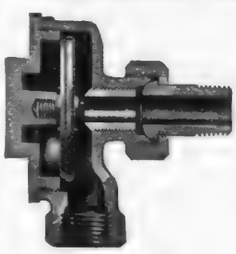
THE POWERS REGULATOR CO
Specialists in Automatic Heat Control

954 Architects Building, New York
565 Greenview Ave., Chicago
2718 Boston Wharf Bldg., Boston
The Canadian Powers Regulator Co., Ltd., Toronto, Ont. (1658)

HEATING IDEAL EQUIPMENT

IDEAL TRAPS

Make Vapor and Vacuum Heating Systems
Efficient and Economical

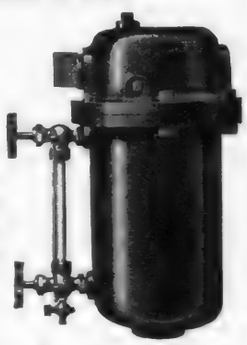


The Ideal Thermostatic Radiator Trap

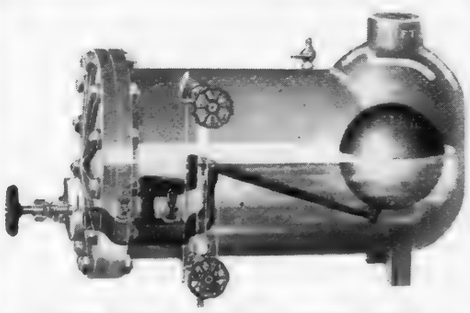
Is built for long, hard service. Its rugged diaphragm withstands corrosive elements and excessive pressures. A reliable trap unaffected by sediment or scale.

The Ideal Alternate Return Trap

Assures a steady water line by returning condensation to the boiler against pressure. Freely removes all air, and makes vapor heating safe.



Ideal Heating Equipment Co.
1897 E. 90th St., Cleveland, Ohio.



THE BEST STEAM TRAP FOR HEATING SYSTEMS

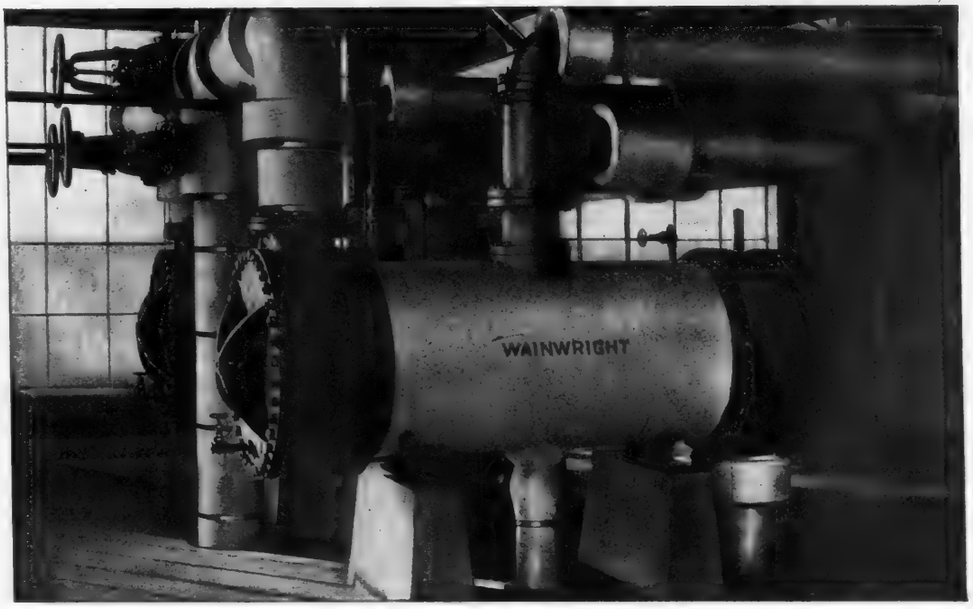
Dry steam is essential to heating systems if operation is to be economical. But dry steam is impossible if the steam lines contain water of condensation.

The Davis Steam Trap automatically keeps steam lines free of condensation—without loss of steam. Service is reliable; they have cone-shaped balanced valves that give unusually large capacity and that will not stick or clog; valves and seats are renewable—made of special bronze, noncorrosive and extra hard.

Let us mail you the catalog descriptive of the complete line of Davis Specialties. Write the G. M. Davis Regulator Co., 436 Milwaukee Ave., Chicago.

DAVIS VALVE
STEAM SAVERS SINCE 1875
SPECIALTIES

HEATING SYSTEM HEATERS



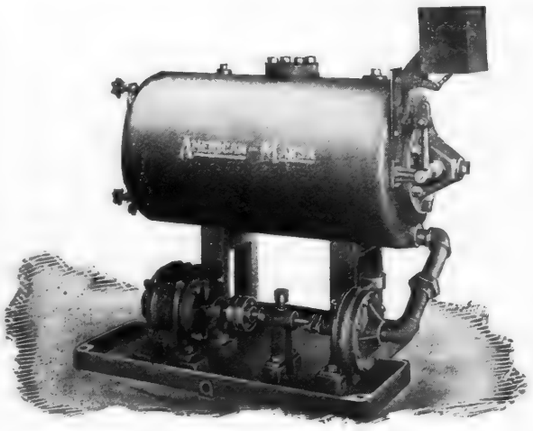
ALBERGER PUMP & CONDENSER COMPANY

140 Cedar Street, New York

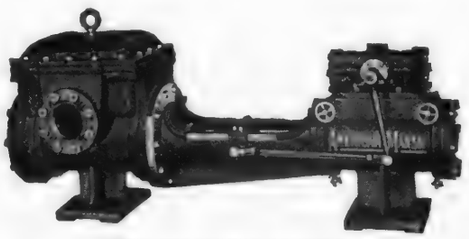
Boston **Chicago** **St. Louis** **Philadelphia**

American-Marsh Pumps

for Heating Systems



For use in returning the condensation to the boiler on heating systems where the steam pressure is too low to operate a steam pump. Water is returned to the boiler in its hottest state. Equipped with an automatic float valve which is positive and reliable.



The Recognized Standard

American-Marsh Vacuum Pumps have been recommended and specified by a majority of the leading heating engineers and Contractors for over twenty years.

Made with only best of material and workmanship. Highest efficiency guaranteed.

Equipped with an improved steam valve which is especially adapted for vacuum service. American-Marsh Pumps are positive in action, possess a perfect governing element and will not hang up under all the varying conditions.

Ask for Bulletins Nos. 24 and 27

AMERICAN STEAM PUMP CO.

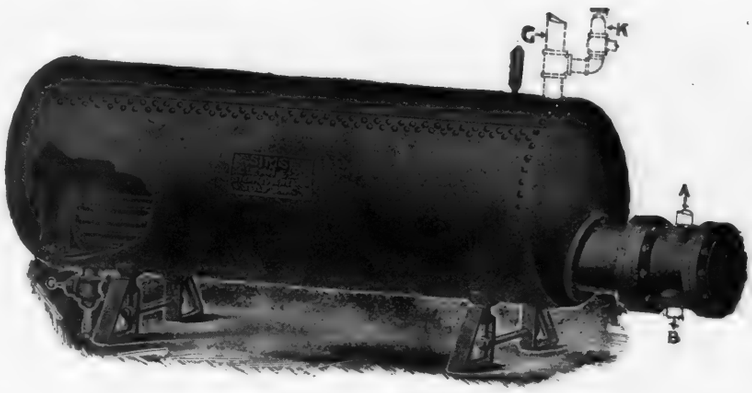
Battle Creek, Mich.

Our slogan: Simplex not Duplex. "To be simple is to be great"

Meet that Peak Demand for Hot Water

WITH A

Sims Clean E-Z Steam Tube Heater



For Hotels, Apartment Buildings, Hospitals, Y. M. C. A. Buildings, Schools, etc.

For Live or Exhaust Steam

Especially Designed for Supplying Large Quantities of Hot Water

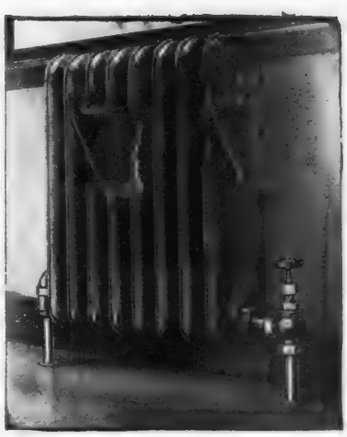
Send for tables showing heat capacities using steam at various pressures

"We keep others in hot water"

THE SIMS CO., 18th St., Erie Pa.

HARTMANN

RADIATOR BRACKETS



WHYS

LABOR SAVED

NO WALL STRIPS

NO BREAKAGE

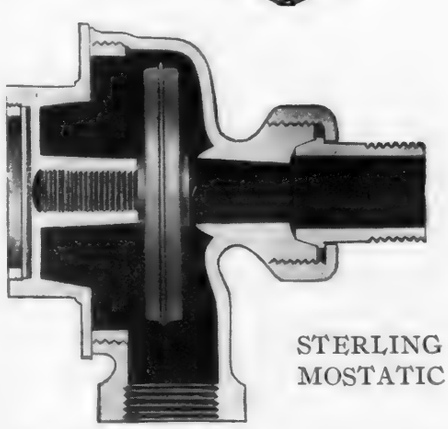
NO DIRT

INEXPENSIVE

Send for descriptive circular and price list

CHARLES HARTMANN CO.
SHEET METAL CONSTRUCTORS
985 Dean St., Brooklyn, N. Y.

STERLING SYSTEMS



STERLING THERMOSTATIC TRAP

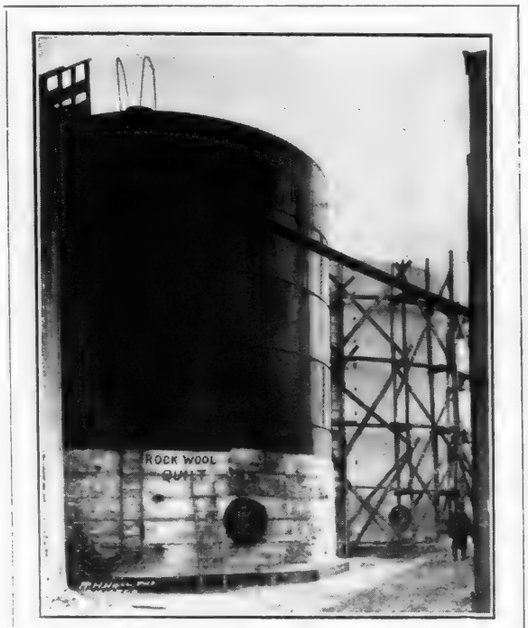
The Sterling Thermostatic Trap is steam tight, yet will free the unit of air and water.

Note the vertical self cleaning seat.

Diaphragm closes against the steam, not with it.

We also manufacture
Return Traps—Air Line Valves—Graduated Supply Valves
—Air Eliminators—Damper Regulators—Strainers

STERLING ENGINEERING COMPANY
Milwaukee Wisconsin



HIGH TEMPERATURE STEEL TANKS

ADAPTABILITY

OF

Banner Rock Wool Quilt

100% FIRE PROOF

HEAT INSULATION

As is shown by the above illustration, Banner Rock Wool Quilt is adaptable for insulating large tanks, tank cars, water and oil stills as well as small household boilers, heaters and such units.

Comparative tests have demonstrated no material has the wide range of adaptability as has this unique material.

Our Engineers will cheerfully co-operate with you in helping solve your insulation problems.

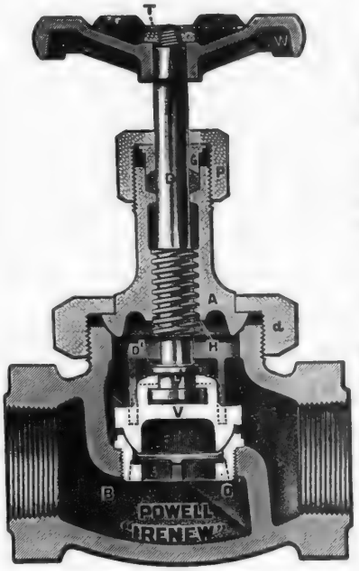
BANNER ROCK PRODUCTS CO.

MANUFACTURERS OF

Heat and Cold Insulation

ALEXANDRIA INDIANA

POWELL VALVES "IRENEW"



All Parts Renewable

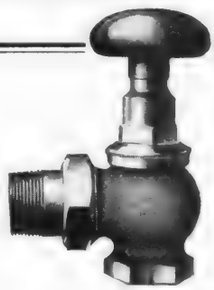
Acid-proof disc and seat ring of non-corrossive white **"Powellium"** bronze.

Iron Body brass mounted on all iron.

Avoid disappointment in valve service by specifying **Powell "Irenew" Valves**

The William Powell Company

CINCINNATI, OHIO



"Genuine Detroit" Packless Radiator Valves

Detroit Packless Radiator Valves are the result of years of experience in the valve manufacturing field—of a careful study of valve needs—of painstaking care on the part of our engineers.

So well do these valves qualify for efficient service—for handsome design and pleasing appearance—for complete satisfaction, that leading architects, heating engineers and master builders, the country over, recommend and specify them for jobs that require the most careful consideration.

They are made for steam, vapor and vacuum heating systems—in all necessary sizes and a variety of styles. Let us send booklet giving full information.

DETROIT LUBRICATOR COMPANY.

DETROIT, U.S.A.

Why you should use a Badger

SELF EQUALIZING EXPANSION JOINT

BECAUSE of unexcelled workmanship and care in manufacture.
Every ring is turned to fit its mating corrugation.
The ends are accurately fitted to the flanges, and the copper turned to fit groove for the steam joint.

Write Us Today for Complete Information

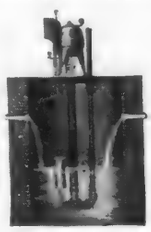
E. B. BADGER & SONS CO.

101 PARK AVE. NEW YORK — PITTS ST., BOSTON — 8 SO. DEARBORN ST. CHICAGO

CELLAR DRAINERS
AUTOMATIC ELECTRIC
7 TO 500 GALLONS MINUTE

SEWAGE EJECTORS AND BILGE PUMPS
30 TO 3000 GALLONS MINUTE

ABSOLUTE GUARANTEES



ECONOMY PUMPING MACHINERY CO.
120-126 No. Curtis St.
CHICAGO

Every Heating Engineer Knows the Advantages of Copper Over Iron

SPECIFY

DAHLQUIST

Copper Boilers

Let us figure on your requirements

DAHLQUIST MFG. CO.
40 West 3rd St. BOSTON, MASS.

P **Preferred by those who recognize true merit in a water Heating System**

A Automatic, requiring no adjustment — and no attention whatever

T Temperature is uniform under all variations of service

T Time is saved by having an unlimited supply of scalding **hot water**

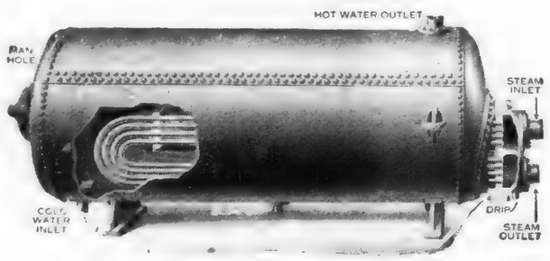
E Efficient and economical. Materials and workmanship unexcelled

R Reliable with nothing to get out of order and cause trouble and delay

S Steam may be either exhaust, high or low pressure live steam

O Operating cost is next to nothing no difference how long in use

N Noted for supplying **Hot Water** for domestic or industrial purposes



The Patterson System of Water Heating for any Service

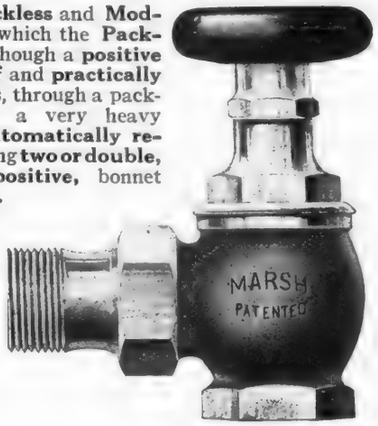
Patterson-Kelly Co.
23 Dey St. New York

MARSH
RE-ENFORCED PACKLESS VALVES

Quick Opening

Note General Lines Carefully

The **ONLY Packless** and **Modulated** Valves in which the **Packless Feature,** although a **positive seal within itself** and **practically indestructible,** is, through a packing cushion and a very heavy special spring, **automatically re-enforced,** providing **two or double, independent, positive,** bonnet seals at **all times.**

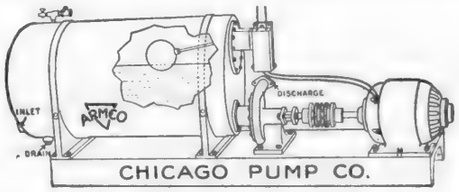


These valves will withstand high pressures and, therefore, are of **superior value** for **vacuum** and **low pressure service.**

We specialize on high grade Radiator Valves and furnish the largest line of any company in the business

Printed matter and prices on application

MARSH VALVE CO., Erie, Pa.



Condensation Pump and Receiver

OF

Highest Possible Quality

AT

Far Lower Price

Manufacturing electric condensation pumps and receivers has nearly always meant special assembling.

The result has been that good condensation pumps have been high priced. In addition, renewal parts are costly and delays are experienced in obtaining them.

In order to overcome the handicaps of the present method, of which those mentioned are only two, we have evolved a new plan of quantity production and standardization for Condensation Pump and Receiver Units.

The outfits we make will be of the highest possible quality and far lower in price than especially built units. Renewal parts will be easily obtainable and replacements made with the least possible delay for the user of this equipment.

Write Us for Full Details. Ask for Our New Catalog and Table of Pumping Engineering Data

CHICAGO PUMP COMPANY
2325 Wolfram St. Chicago, Ill.

GLEOCKLE WALL RADIATOR BRACKET

(Patented)

Possesses Advantages of

Universal Adjustment

Ease of Erection

Made of Wrought Iron

Unbreakable

Rustless

Fitting all Makes of Wall Radiators

Available for Immediate Shipment

Write for Descriptive Booklet and Trade Discounts

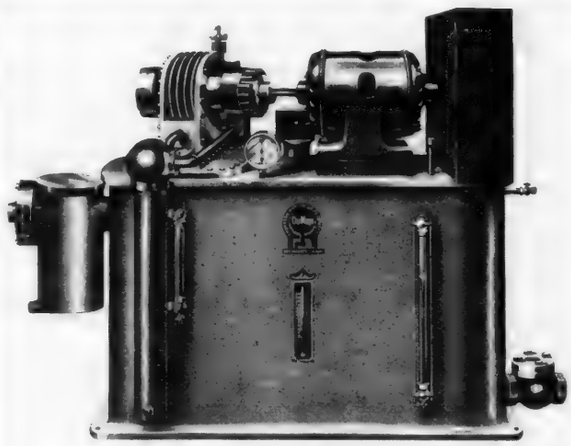
A. F. Gleockle, Jr.
415 Bay St.
ROCHESTER, N. Y.

Those Sudden Breaks

THE pipe house that is equipped with a "Toledo" Portable Power Drive and "Toledo" geared threaders and cutters is fully prepared to cope with emergency pipe fitting jobs quickly and easily. Get acquainted with the "Toledo" line. Ask us for catalog "F."

The Toledo Pipe Threading Machine Co.
TOLEDO, OHIO
New York Office:
50 Church St., New York City

TOLEDO DRIVE
PORTABLE POWER



Use Only Half *the Power*

THIS improved return line system is built on an *entirely new* principle.

Instead of pumping the hot condensation water directly back into the boiler it creates a vacuum on the tank under the pump, drawing the water into the tank. Then it automatically reverses, putting the tank under pressure, and forcing the water back into the boiler,

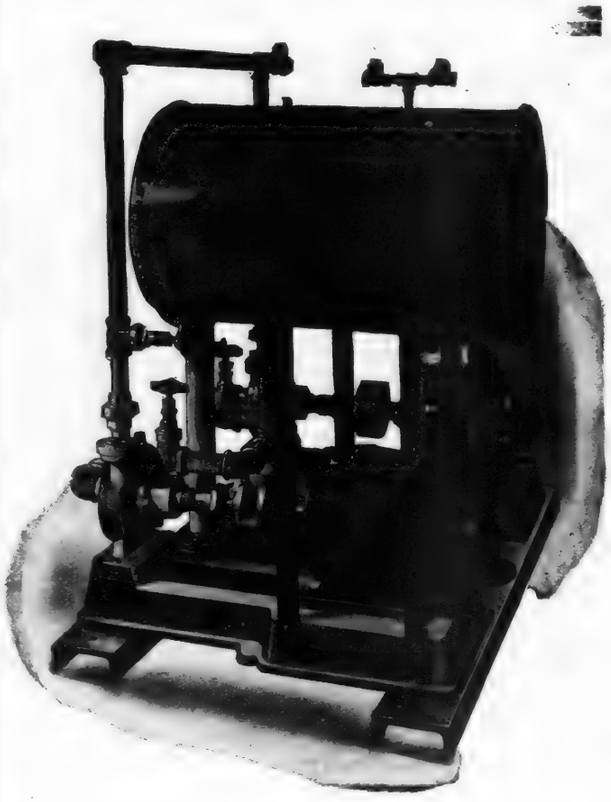
No hot water touches the pump. There is no corrosion of the working parts. Vacuum is maintained 9 1/2 minutes out of every ten with the motor running only part of the time. No packing to wear out and leak hot water all over the floor. Friction is reduced to a minimum—power reduced one-half—effectiveness increased—repairs almost eliminated—and the life of the system prolonged.

Investigate—before you start that next big job.

Thompson's Du Moin Vacuum Return Line Pump

Write today for Bulletin 4 with full explanation of the new principle and its advantages, blue prints, specifications and prices.

Thompson Mfg. Co.
813 24th St. DES MOINES, IOWA



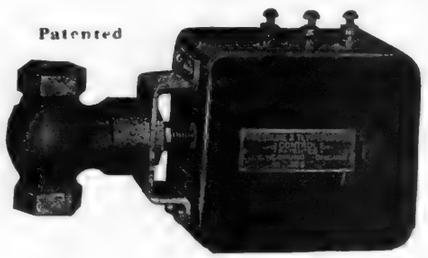
Save Coal

by installing the Thomas Automatic Condensation Units, made in all srzes and descriptions, assembled single and double.

Compact
Durable
Reliable
Efficient

Write for Descriptive Circular

THOMAS PUMP WORKS
154 Spring Street **NEW YORK**

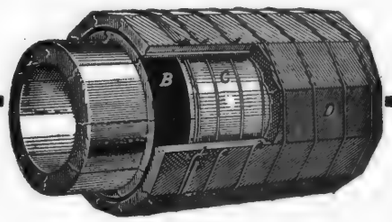


The
HORNUNG
Magnetic Valve

This is the little valve used as a pilot on all sizes of HORNUNG PRESSURE and TEMPERATURE CONTROL VALVES. It has many other uses.

Ask for Catalogue No. 14

CENTRAL HEAT APPLIANCES
J. C. HORNUNG
343 South Dearborn St. **Chicago**



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes with

Wyckoff's
Improved
Cypress Covering

Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Absolutely water and steam tight. Each shell is wound with extra-heavy steel wire. Coated all over with the best known preservative—**Montezuma Asphalt.**

Write for catalog

A. WYCKOFF & SON CO.
ELMIRA, N. Y.

PYRO-BESTOS

Underground Pipe Insulation

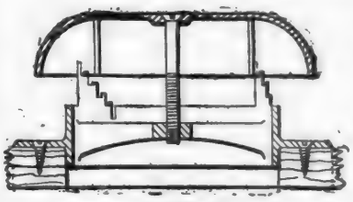
For piping from central heating plants or power stations to detached buildings of Universities, Asylums, Hospitals, Factories, etc. Also an underground Pipe Conduit for heating private Auto Garages direct from House heating systems.

Cannot rot or decay nor will it retain moisture to rust and destroy the piping during non-heating season.

Saves most coal, sends dry steam to a greater distance and by reason of its advanced common sense method of installation is at the same time a lower cost per foot of pipe covered than any other Underground Pipe Insulation on the market.

National Asbestos Mfg. Co.
163-193 Henderson Street, Jersey City, N. J.

FRESH AIR for THEATRES
AND ALL AUDITORIUMS



The "Notch" Diffuser will distribute the air uniformly.

It is easily adjusted to different openings and locked.

PATENTED

Made of Cast Iron and for either wood or concrete floors
ALSO AISLE HOODS DAMPER AND SCREW TYPES

Knowles Mushroom Ventilator Co.
Telephone: Cortlandt 2090 202-204 Franklin St., New York

Carrier Engineering Corporation

Carrier AIR CONDITIONING AND DRYING EQUIPMENT

39 Cortlandt St.
NEW YORK, N. Y.

Boston Philadelphia
Buffalo Chicago

Carrier AIR CONDITIONING AND DRYING EQUIPMENT

Air Conditioning and Drying

Humidification Dehumidification Cooling
Heating Ventilation Purification

High Temperature Air Heaters for
Drying Processing Baking
up to 1000° F.

We invite correspondence

Make "Every day a *good* day" with
MANUFACTURED WEATHER

Young Centrifugal Vacuum and Boiler Feed Outfits

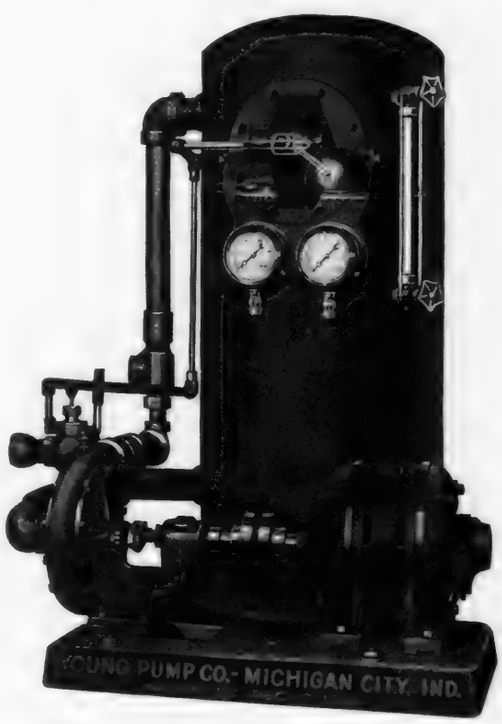
Consist of a centrifugal pump with motor direct connected, tank, exhauster and balanced by-pass valve. The pump, motor and tank are mounted on a substantial cast iron base and the outfit completely assembled as shown in the cut, so that as received on the job it is only necessary to make pipe connections to the system and boiler, wiring connections to the motor, when it is ready for operation.

It is the simplest outfit made. There are no valves, springs or other parts that require adjustment, wear out or cause repair expense; not a feature more complicated or liable to cause trouble than the motor.

Made in six sizes to handle 4,000, 8,000, 16,000, 26,000, 40,000 or 65,000 sq. ft. of radiation; for continuous operation or automatic control, to meet any condition or pressure.

Complete information and prices upon application.

Write for Descriptive Pamphlet



CHICAGO OFFICE
327 S. La Salle St. Phone Harrison 5920

ENGINEERS' SPECIFICATION INDEX

AIR COMPRESSORS.
Nash Engineering Co., So. Norwalk, Conn.
Plant Engineering & Equipment Co., New York.

AIR CONDITIONING APPARATUS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corporation, Philadelphia, Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Spray Engineering Co., Boston, Mass.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

AIR COOLERS.
Alberger Heater Co., Buffalo, N. Y.
Badger & Sons Co., E. B., Boston Mass.
Griscom-Russell Co., New York.

AIR COOLING AND DRYING SYSTEMS.
Atmospheric Conditioning Corp., Phila., Pa.
Buffalo Forge Co., Buffalo., N. Y.
Carrier Engineering Corporation, New York.
Clarage Fan Co., Kalamazoo, Mich.
W. L. Fleisher Co., New York, N. Y.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Spray Engineering Co., Boston, Mass.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

AIR ELIMINATORS.
Jas. P. Marsh & Co., Chicago, Ill.

AIR SEPARATORS.
Griscom-Russell Co., New York.
Hoffman Specialty Co., New York.

AIR WASHERS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Buffalo Forge Co., Buffalo. N. Y.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Mellish Hayward Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Spray Engineering Co., Boston, Mass.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

BLOWERS.
Fan.
American Blower Co., Detroit, Mich.
Batterman-Truitt Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hackney Mfg. Co., St. Paul, Minn.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

Pressure.
American Blower Co., Detroit, Mich.
Batterman-Truitt Co., Chicago, Ill.
Buffalo, Forge Co., Buffalo, N. Y.
Connersville Blower Co., Connersville, Ind.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

Rotary.
Connersville Blower Co., Connersville, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

Turbine.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Plant Eng'g& Equipment Co., New York.
L. J. Wing Mfg. Co., New York .

BOILER BREECHINGS.
Hartmann Co., Charles, Brooklyn, N. Y.
Johns-Manville, Inc., New York.

BOILERS.
Copper.
Dahlquist Mfg. Co., Boston, Mass.

Heating.
American Radiator Co., Chicago, Ill.
Cox Stove Co., Abram, Philadelphia, Pa.
Gorton & Lidgerwood Co., New York.
Gurney Heater Mfg. Co., Boston, Mass.
Illinois Malleable Iron Co., Chicago, Ill.
International Heater Co. Utica, N. Y.
Kewanee Boiler Co., Kewanee, Ill.
Page Boiler Co., Wm. H., New York.
Standard Heater Co., Williamsport, Pa.
Titusville Iron Works Co., Titusvile, Pa.
Utica Heater Co., Utica, N. Y.

Down-draft.
American Radiator Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Page Boiler Co., Wm. H., New York.
Utica Heater Co., Utica, N. Y.

CALORIMETERS.
Sarco Co., New York.
Schaefer & Budenberg Mfg. Co., Brooklyn, N. Y.

COILS, PIPE.
Simmons Co., John, New York.

Air.
New York Blower Co., Chicago, Ill.

COOLERS.
Oil.
Griscom-Russell Co., New York.

CONDENSERS.
Alberger Heater Co., Buffalo, New York.
Alberger Pump & Condenser Co., New York.
American Radiator Co., Chicago, Ill.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONVERTERS, HOT WATER.
Patterson-Kelley Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

COVERING, PIPE.
American District Steam Co., No. Tonawanda, N. Y.
Century Conduit Co., Pittsburgh, Pa.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

DAMPERS, DUCT.
Sixth City Sheet Metal Works, Co., Cleveland,O

DEHUMIDIFYING APPARATUS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

DISTILLERS.
Water.
Griscom-Russell Co., New York.

DRYING SYSTEMS.
(See Air Cooling and Drying Systems.)

DUST COLLECTING SYSTEMS.
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

DUST COLLECTORS.
Atmospheric Conditioning Corp., Phila., Pa.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F. Hyde Park, Boston, Mass.

DUST DETERMINATORS.
Atmospheric Conditioning Corp., Phila., Pa.

ECONOMIZERS, FUEL.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

EQUALIZING LOOPS
Hoffman Specialty Co., New York.

EXHAUST SYSTEMS.
Hartmann Co., Charles, Brooklyn, N. Y.

ENGINES.
Steam, Automatic.
American Blower Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F. Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Steam, High Speed.
American Blower Co., Detroit, Mich.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

EVAPORATORS.
Boiler Feed Make-up.
Griscom-Russell Co., New York.

EXHAUST HEADS.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Simmons, Co., John, New York.
Surtevant Co., B. F., Hyde Park, Boston, Mass.
Wright-Austin Co., Detroit, Mich.

EXPANSION JOINTS.
Alberger Pump & Condenser Co., New York.
American District Steam Co., No. Tonawanda, N. Y.
Century Conduit Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
Ric-Wil Co., Cleveland, O.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Webster & Co., Warren, Camden, N. J.

FANS, EXHAUST.
American Blower Co., Detroit, Mich.
Batterman-Truitt Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hackney Mfg. Co., St. Paul, Minn.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co,. New York.

FILTERS.
Aerating.
Griscom-Russell Co., New York.
Johns-Manville, Inc., New York.

Feed-water.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.

FITTINGS, FLANGED
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Simmons Co., John, New York.

FLANGES.
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., N. Y.

GAS BURNERS.
Cleveland Gas Burner & Appliance Co., Cleveland, Ohio.

GASKETS, METALLIC.
Johns-Manville, Inc., New York.
Sarco Co., New York.

GAUGE BOARDS.
Bishop & Babcock Co., Cleveland, O.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
McAlear Mfg. Co., Chicago. Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Taylor Instrument Co., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

GAUGES.
Draft.
American Steam gauge & Valve Mfg. Co., Boston, Mass.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Hydraulic.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Ounce Graduated.
Jas. P. Marsh & Co., Chicago, Ill.

Pressure.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
American Dist. Steam Co., North Tonawanda, N. Y.
Marsh & Co., Jas. P., Chicago. Ill.
McAlear Mfg. Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Webster & Co., Warren, Camden, N. J.

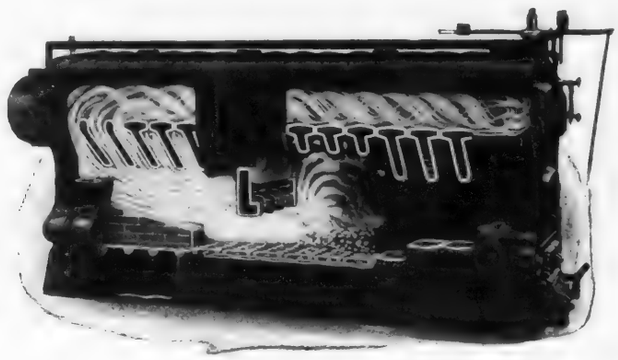
Vacuum.
Bishop & Babcock Co., Cleveland, O.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Marsh & Co., Jas. P., Chicago. Ill.
McAlear Mfg. Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Taylor Instrument Co., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

Water.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
American District Steam Co., No. Tonawanda, N. Y.
Detroit Lubricator Co., Detroit, Mich.
Jenkins Bros., New York.

GENERATING SETS.
American Blower Co., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GENERATOR COOLING SYSTEMS.
Atmospheric Conditioning Corp., Phila., Pa.

GOVERNORS, PUMP.
Atlas Valve Co., Newark. N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Plant Engineering & Equipment Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.



Sectional view of Imperial Super-Smokeless Boiler, showing Hot Blast Chamber.

Because Coal is High and Grade Low

HEATING systems are being prepared for another season. Owners of buildings are contemplating costs and service. Now is the time to prove to them that the installation of the Imperial Super-Smokeless Boiler would be real economy.

They know that the price of coal is high and the grade low. Hence, the big selling feature of the Imperial—namely—any kind or grade of coal or coke can be burned and even the smoke is consumed for heating purposes. The secret of its success is the Hot Blast Chamber at the rear of the fire-box. Here are caught and burned all those rich gases and smoke that usually leave the chimney unconsumed.

In a short time the Imperial Super-Smokeless Boiler pays for itself. Convince your prospects by showing them the successful installations in your vicinity.

A word from you will bring full particulars. We have users in your vicinity who will be pleased to recommend this boiler to you. Send for their names.

Utica Heater Co., Utica, N. Y.

218-220 West Kinzie St., CHICAGO

Imperial Super-Smokeless Boilers

ENGINEERS' SPECIFICATION INDEX (Continued).

HEATERS.

DOMESTIC WATER.

Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., No. Tonawanda, N. Y.
American Radiator Co., Chicago, Ill.
Dahlquist Mfg. Co., Boston, Mass.
Excelso Specialty Works, Buffalo, N. Y.
Griscom-Russell Co., New York.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sims Co., Erie, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

FEED WATER (Closed).

Alberger Heater Co., Buffalo, N. Y.
Alberger Pump & Condenser Co., New York.
Griscom-Russell Co., New York.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Simmons Co., John, New York.
Sims, Co., Erie, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

FEED WATER (Open).

Griscom-Russell Co., New York.
Sims Co., Erie, Pa.
Webster & Co., Warren, Camden, N. J.

FUEL-OIL.

Griscom-Russell Co., New York.

PIPE COIL (AIR).

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

HEATING SYSTEMS.

UNIT BLAST.

American Blower Co., Detroit, Mich.
BattermanTruitt Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

UNIT AIR.

Moline Heat, Moline, Ill.

GRAVITY AND FORCED CIRCULATION, WATER.

Alberger Heater Co., Buffalo, N. Y.

VACUUM.

Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

VAPOR.

American District Steam Co., No. Tonawanda, N. Y.
Dunham Co., C. A. Chicago, Ill.
Haines & Co., Wm. S., Philadelphia, Pa.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Il.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Moline Heat, Moline, Ill.
Sarco, Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

HUMIDIFIERS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
Douglass & Co., Thos. J., Chicago, Ill.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago Ill.
Spray Engineering Co., Boston, Mass.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

HUMIDITY CONTROL.

Atlas Valve Co., Newark, N. J.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass,

HYGROMETERS.

Jas. P. Marsh & Co., Chicago, Ill.
Taylor Instrument Cos., Richester, N. Y.

INSTRUMENTS.

ELECTRIC MEASURING.

Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

INDICATING AND RECORDING.

Johns-Manville, Inc., New York.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Sarco Co., New York.
Sixth City Sheet Metal Works Co., Cleveland, O.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

INSULATING MATERIALS.

American District Steam Co., No. Tonawanda, N. Y.
Banner Rock Products Co., Alexandria, Ind.
Century Conduit Co., Pittsburgh, Pa.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Weatherstrip Manufacturers' Association.
Wyckoff & Sons, A., Elmira, N. Y.

MANOMETERS.

Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

MECHANICAL DRAFT APPARATUS.

American Blower Co., Detroit, Mich.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Plant Engineering & Equipment Co., New York.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

METERS.

CONDENSATION.

American Dist. Steam Co., No. Tonawanda,
Central Station Steam Co., Detroit, Mich.
Hornung, J. C., Chicago, Ill.
Plant Engineering & Equipment Co., New York.

FEED WATER.

Simmons Co., John, 110 Center St., New York.

(FEED WATER (Wier Type).

Webster & Co., Warren, Camden, N. J.

PITOT TUBE.

American Blower Co., Detroit, Mich.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

STEAM.

American District Steam Co., No. Tonawanda, N. Y.

MOTORS.

ELECTRIC.

Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

OZONATORS.

Ozone Pure-Airifier Co., Chicago, Ill.

PAINT, FOR HEATED SURFACES.

Ric-Wil Co., Cleveland, O.

PIPE.

SOIL.

Simmons Co., John, 110 Center St., New York.

STEEL.

Simmons Co., John, 110 Center St., New York.

WROUGHT IRON.

Simmons Co., John, 110 Center St., New York.

WOOD.

Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE BENDING.

Buffalo Forge Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Simmons Co., John, 110 Center St., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING, WOOD.

American District Steam Co., No. Tonawanda, N. Y.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE HANGERS.

Jenkins Bros., New York.
Simmons Co., John, New York.

PIPE CUTTING AND THREADING MACHINES.

Crane Co., Chicago, Ill.
Toledo Pipe Threading Machine Co., Toledo, O.

PIPING, POWER.

Crane Co., Chicago, Ill.
Simmons Co., John, New York.

POWER PLANT SUPPLIES.

American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Johns-Manville Co., New York.
Plant Engineering & Equipment Co., New York.
Simmons Co., John, New York.

PUMPS.

BOILER FEED.

American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Plant Eng'g & Equipment Co., New York.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

CENTRIFUGAL.

Alberger Pump & Condenser Co., New York.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Plant Engineering & Equipment Co., New York.
Sprague Electric Works, New York
Thomas Pump Works, New York.
Yeomans Bros. Co., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

CONDENSATION.

American Steam Pump Co., Battle Creek, Mich.
Chicago, Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Nash Engineering Co., So. Norwalk, Conn.
Thomas Pump works, New York.
Thompson Mfg. Co., Des Moines, Ia.
Trane Co., La Crosse, Wis.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros. Co., Chicago, Ill.

ROTARY.

Connersville Blower Co., Connersville, Ind.
Nash Engineering Co., So. Norwalk, Conn.
Thomas Pump Works, New York.
Thompson Mfg. Co., Des Moines, Ia.
United Vacuum Appliance Division, Connersville, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

STEAM.

American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Ideal Heating Equipment Co., Cleveland, O.
Nash Engineering Co., So. Norwalk, Conn.
Plant Engineering & Equipment Co., New York.

TURBINE.

Alberger Pump & Condenser Co., New York.
Buffalo Steam Pump Co., Buffalo, N. Y.
Nash Engineering Co., So. Norwalk, Conn.
Yeomans Bros., Chicago, Ill.

VACUUM.

American Steam Pump Co., Battle Creek, Mich.
Bishop & Babcock Co., Cleveland, O.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Connersville Blower Co., Connersville, Id.
Economy Pumping Machinery Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Trane Co., La Crosse, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Yeomans Bros., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

PYROMETERS.

Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RADIATOR HANGERS.

Gloeckle, Jr., A. F., Rochester, N. Y.
Hartman Co., Chas., Brooklyn, N. Y.
Healy-Ruff Co., Minneapolis, Minn.

RADIATORS, STEAM AND WATER.

American Radiator Co., Chicago, Ill.
Gurney Heater Mfg. Co., Boston, Mass.
International Heater Co., Utica, N. Y.
Simmons Co., John, New York.

RECEIVERS.

AIR.

American District Steam Co., No. Tonawanda, N. Y.
Sterling Engineering Co., Milwaukee, Wis.

CONDENSATION.

Allenclif Engineering Co., Columbus, O.
Chicago Pump Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Thomas Pump Works, New York.
Yeomans Bros., Chicago, Ill.

REGULATORS.

BOILER-FEED.

McAlear Mfg. Co., Chicago, Ill.
Thomas Pump Works, New York.
National Regulator Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.

DAMPER.

American Dist. Steam Co., No. Tonawanda. N. Y.
Atlas Valve Co., Newark, N. J.
American Radiator Co., Chicago. Ill.
Bishop & Babcock Co., Cleveland, O.
Davis Regulator Co., G. M., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Moline Heat, Moline, Ill.
National Regulator Co., Chicago, Ill.
Plant Engineering & Equipment Co., New York.
Sixth City Sheet Metal Works Co., Cleveland, O.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
L. J. Wing Mfg. Co., New York.

PRESSURE.

American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago.
Mason Regulator Co., Boston, Mass.
National Regulator Co., Chicago, Ill.

BOOKS ON HEATING AND VENTILATING

MECHANICAL EQUIPMENT OF FEDERAL BUILDINGS. By Nelson S. Thompson. Third revised edition, covering the basic data used by the Treasury Department in the design of the entire mechanical equipment of Federal Buildings under its control. Includes data on heating and ventilating, plumbing, drainage and water supply systems, gas piping, conduit, and wiring systems, lighting fixtures, elevators, small power plants, motors and controlling apparatus, vacuum cleaning systems, operating data, etc. Size 6 x 9 in. 400 pages. Cloth $4.00.

VENTILATING DUCTS. By C. E. Pearce. A set of six tables printed on heavy Bristol board, for rapidly estimating the superficial area and weights of galvanized iron rectangular ducts used in ventilating work. Size 7 x 9 in. Price, 50 cents.

MECHANICAL EQUIPMENT OF BUILDINGS. Vol. 1. Heating and Ventilation. By Louis A. Harding and Arthur C. Willard. One of the most complete treatises ever published on this subject. Written for the practicing engineer, as well as for the student. Size 7 x 9½ in., flexible binding. 621 pages and profusely illustrated. Price $6.00.

Vol. II. Power Plants and Refrigeration. An equally complete treatise, illustrating and describing in detail modern power-plant design and refrigerating practice. Size 6¾ x 9¾ in., flexible binding. 766 pages, many illustrations. Price $7.00.

Vol. III. Miscellaneous Building Equipment in preparation, including lighting, elevators, vacuum cleaning, sprinkler systems, plumbing, etc.

HEATING AND VENTILATION. By Prof. John R. Allen and J. H. Walker. This is the latest work to make its appearance on this subject and is designed as a text book for use in the engineering and architectural schools, as well as for the practicing engineer and architect. Size 6 x 9 in., 305 pages. Cloth, $3.50.

STEAM PIPING, ITS ECONOMICAL DESIGN AND CORRECT LAYOUT. By A. Langstaff Johnston, Jr. An analysis of the factors governing the flow of steam in pipes with numerous large curves for use in solving the problems of practical installation and determining the most economical size of pipe for any given set of conditions. Pp. 62. Size 5 x 7½ in. Cloth, $2.00.

PROGRESSIVE FURNACE HEATING. By Alfred G. King. A practical manual of designing, estimating and installing modern systems for heating and ventilating buildings with warm air. Written especially for contractors and mechanics. Size 6 x 9 in. 280 pages. 189 illustrations. Price, $3.00, postpaid.

PIPE FITTING CHARTS. By William G. Snow. A valuable reference work for the solution of knotty problems in connecting up steam radiators, boilers and the variety of appliances used in combination high and low pressure plants. 285 illustrations. Price, $2.00.

STEAM POWER PLANTS: Their Design and Construction. By Henry C. Meyer, Jr., M. E. Third edition, fully revised. One of the standard works on the design and construction of power plants. Covers proportioning boilers, selection and writing specifications for steam engines, selection and arrangement of auxiliaries, construction of chimneys, coal handling, etc. 219 pages. Size 6 x 9 in. Illustrated with folding Plates. Price, $2.00 postpaid.

DESIGNING HEATING AND VENTILATING SYSTEMS. By Charles A. Fuller. A text book which treats both the theoretical and practical side of the subject in a simple, but clear and comprehensive manner. Instruction given covering the design any kind of heating or ventilating system. 224 pages. Size 6 x 9 in. 78 figs. and 37 tables. Cloth, $2.50.

PRACTICAL STEAM AND HOT WATER HEATING. By Alfred G. King. Containing over 300 detailed illustrations. The book is a working manual for heating contractors, journeymen steam fitters, architects and builders. Describes various systems, of heating and ventilation and includes useful data and tables for estimating, installing and testing such systems. 8vo. 367 pages. Price, $3.50.

MECHANICS OF HEATING AND VENTILATING. By Konrad Meier. Including a series of ten charts containing data relating to the flow of water, steam and air, collected by Mr. Meier during an experience of 26 years in heating and ventilating work, both in this country and abroad. Each of the charts replaces a series of tables on the subject, giving at a glance the result of a calculation from any combination of factors. 161 pages, illustrated, with ten large charts. Size 6 x 9 in. Price, $5.00. Separate sets of charts, printed on cloth, with lines in different colors and mounted on boards. Single charts, $1.50. Sets of ten, $15.00.

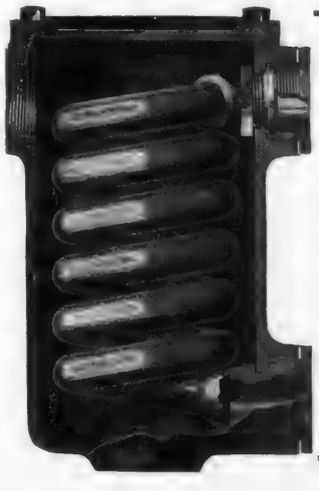
HEATING AND VENTILATING BUILDINGS, a standard manual for heating engineers and architects. By. Prof. R. C. Carpenter. Sixth edition, largely rewritten. 577 pages, 277 illustrations, 8vo, cloth, $3.50.

HANDBOOK FOR HEATING AND VENTILATING ENGINEERS. By James D. Hoffman. Fourth edition of this important work, entirely rewritten and reset. A standard manual covering theory and practice, with special chapters on heat losses, furnace heating, water and steam heating, mechanical vacuum heating, mechanical warm-air heating, temperature control, electrical heating and refrigeration. With appendix of 75 tables. Size 4½ x 6¾ in. Pp. 478. Price $4.50, postpaid.

CENTRAL STATION HEATING—By Byron T. Gifford. Second edition. Important new chapters on costs and accounting, replacement and renewal reserve and how to figure it, and economics and design of high-pressure distribution systems are included in the new edition of this work, which presents the most advanced practice in central station heating, both steam and hot water. Central Station Heating is used as a guide in many states of the public utility commissions. 280 pages with 46 illustrations including 40 pages of miscellaneous engineering data. Size 6 x 9½ ins., bound in cloth. Price $4.00.

DISTRICT HEATING.—By S. Morgan Bushnell and Fred B. Orr. This book not only imparts a general knowledge of district heating, but contains many points on economical operation, as illustrated in the methods practiced by central station heating companies which have been successful in this field. Comparative data are also presented indicating the prices that can reasonably be charged for heating service. Size 6 x 9 in. 300 pages. 81 figs. Cloth, $4.00.

The Heating and Ventilating Magazine, 1123 Broadway New York



The New Excelso Water Heater

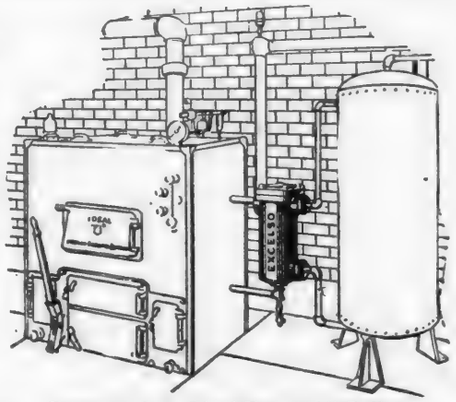
Eliminates Fire-Pot Pipe Coils

The Excelso Heater, connected below the water-line of steam or vapor boilers, will generate domestic hot water constantly, day and night, as long as there is any fire, at practically no cost.

The copper coil is connected into heater without packing. Made in five sizes for tank capacities as follows:

No. 11	No. 12	No. 13	No. 14	No. 15
30 gal.	45 gal.	70 gal.	90 gal.	120 gal.

EXCELSO SPECIALTY WORKS
119 Clinton St. Buffalo, N. Y.



Connected to Ideal Type "A" Boiler

GURNEY BOILERS RADIATORS
FOR HEATING ANY DESCRIPTION OF BUILDING BY STEAM OR HOT WATER
GURNEY HEATER MANUFACTURING CO.
HEAD OFFICE 188-200 FRANKLIN ST. BOSTON, MASS. SHOWROOMS NEW YORK-PHILADELPHIA-WASHINGTON

ENGINEERS' SPECIFICATION INDEX (Continued).

TEMPERATURE.
American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, O.
Carrier Engineering Corporation, New York.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.

SEPARATORS.
OIL.
Griscom-Russell Co., New York.
Wright-Austin Co., Detroit, Mich.
STEAM.
American District Steam Co., No. Tonawanda, N. Y.
Bishop & Babcock Co., Cleveland, O.
Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Plant Engineering & Equipment Co., New York.
Sims Co., Erie, Pa.
Webster & Co., Warren Camden, N. J.
Wright-Austin Co., Detroit, Mich.

SHEET METAL CONSTRUCTION.
Hartmann Co., Charles, Brooklyn, N. Y.

SPRAY COOLING SYSTEMS.
Atmospheric Conditioning Corp., Phila,, Pa.
Massachusetts Blower Co., Watertown, Mass.
Spray Engineering Co., Boston, Mass.

STACK LININGS
Johns-Manville, Inc., New York.

STRAINERS.
OIL.
Griscom-Russell Co., New York.
STEAM.
American Dist. Steam Co., No. Tonawanda, N. Y.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.

THERMOMETERS, RECORDING AND INDICATING.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Taylor Instrument Cos., Rochester, N. Y.
WATER.
Marsh & Co., Jas. P., Chicago, Ill.

THERMOSTATS.
American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, O.
Fulton Co., Knoxville, Tenn.
Johnson Service Co., Milwaukee, Wis.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.

TRAPS.
CONDENSER.
McAlear Mfg. Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.
RADIATOR.
Bishop & Babcock Co., Cleveland, O.
Dole Valve Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York .
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Moline Heat, Moline, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.
RETURN.
American Blower Co., Detroit, Mich.
Dunham Co., C. A., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.
STEAM.
American Blower Co., Detroit, Mich.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A ., Chicago, Ill.
Haines & Co,. Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P.. Chicago, Ill.
Patterson-Kelley Co., New York.
Plant Engineering & Equipment Co., New York.
Sarco Co., New York.
Simmons Co., John, New York.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Trane Co., La Crosse, Wis.
Wright-Austin Co., Detroit, Mich.
VACUUM.
American Blower Co., Detroit, Mich.
Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

TURBINES, STEAM.
Buffalo, Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

TURBO-BLOWERS.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass,

UNDERGROUND PIPE CONDUITS.
American District Steam Co., No. Tonawanda, N. Y.
Century Conduit Co., Pittsburgh, Pa.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

VACUUM CLEANING APPARATUS.
American Radiator Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
United Vacuum Appliance Division, Connersville Id.

VALVES.
AIR (Automatic).
American Radiator Co., Chicago, Ill.
Commonwealth Brass Corporation, Detroit, Mich.
Fulton Co., Knoxville, Tenn.
Wm. S. Haines & Co., Philadelphia, Pa.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Simmons Co., John, New York.
AIR RELIEF.
American District Steam Co., No. Tonawanda, N. Y.
Fulton Co., Knoxville, Tenn.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
The Wm. Powell Co., Cincinnati, O.
Webster & Co., Warren, Camden, N. J.
BACK PRESSURE.
Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.
BALANCED.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
BLOW-OFF.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Simmons Co., John, New York.
The Wm. Powell Co., Cincinnati, O.
CHECK.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
The Wm. Powell Co., Cincinnati, O.
Simmons Co., John, New York.
GATE.
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Dole Valve Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Erie, Pa.
Simmons Co., John, New York.
The Wm. Powell Co., Cincinnati, O.
GLOBE, ANGLE AND CROSS.
Crane Co., Chicago, Ill.
Dole Valve Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Erie, Pa.
Simmons Co., John, New York.
The Wm. Powell Co., Cincinnati, O.
HYDRAULIC-OPERATING.
Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
NON-RETURN.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.
The Wm. Powell Co., Cincinnati, O.
RADIATOR.
American Radiator Co., Chicago, Ill.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, O.
Commonwealth Brass Corporation, Detroit, Mich.
Crane Co., Chicago, Ill.
Detroit Lubricator Co., Detroit, Mich.
Dole Valve Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Gorton & Lidgerwood Co., New York.
Gurney Heater Mfg. Co., Boston, Mass.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
McAlear Mfg. Co., Chicago, Ill.
McDonald Under-Seat Valve Co., Cleveland, O.
Marsh Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Erie, Pa.
Simmons Co., John, New York.
Sterling Engineering Co., Milwaukee, Wis.
The Wm. Powell Co., Cincinnati, O.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.
REDUCING.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M. Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kennedy Valve Mfg. Co., Elmira, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Powers Regulator Co., Chicago, Ill.
The Wm. Powell Co., Cincinnatti, O.
REGULATING.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Plant Engineering & Equipment Co., New York.
The Wm. Powell Co., Cincinnati, O.
SAFETY.
American District Steam Co., No. Tonawanda, N. Y.
Jenkins Bros., New York.
The Wm. Powell Co., Cincinnati, O.
STOP AND CHECK (See Valves, Non-Return.)

VENTILATING HEATERS.
American Blower Co., Detroit, Mich.
American Radiator Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Bros. Co., Allentown, Pa.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Massachusetts Blower Co., Watertown, Mass.

VENTILATING SYSTEMS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Batterman-Truitt Co., Chicago, Ill.
Buffalo Forge Co. Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Hackney Mfg. Co., St. Paul, Minn.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Moline Heat, Moline, Ill.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sprague Electric Works, New York
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

VENTILATORS.
Allen Air-Turbine Ventilator Co., Detroit, Mich
Buffalo Forge Co., Buffalo, N. Y.
Buckeye Blower Co., Columbus, O.
Hersh Bros. Co., Allentown, Pa.
Johns-Manville Co., H. W., New York.
New York Blower Co.. Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston. Mass,
L. J. Wing Mfg. Co., New York.
MUSHROOM.
Hersh Brothers Co., Allentown, Pa.
Knowles Mushroom Ventilator Co., New York
New York Blower Co., Chicago. Ill.

By Repute "Always" Reliable

Mason Reducing Valves have an extraordinary reputation for three things—long life, continuous service and reliability, which is, after all, only a natural tribute earned through merit.

MASON REDUCING VALVES

are made in many types and sizes, and every type and every size can be depended upon to reduce and maintain pressure at the proper delivery point, regardless of the fluctuation in the initial pressure.

To make your assurance doubly sure, Mason service is never separated from Mason products.

If pressure regulation problems trouble you, make use of our service.

MASON REGULATOR COMPANY

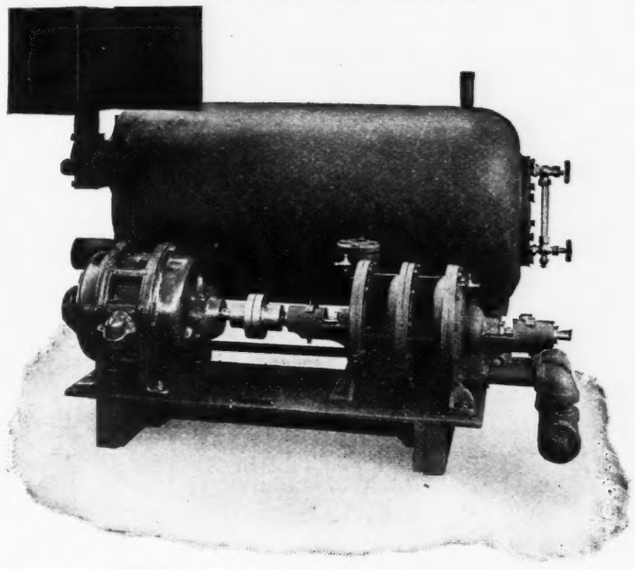
Boston, Mass. San Francisco, Cal. Montreal, Canada

YEOMANS

ELECTRICALLY OPERATED

CONDENSATION RETURN PUMPS

HORIZONTAL AND VERTICAL



SPECIAL TYPE H HIGH PRESSURE UNIT

RUGGED **RELIABLE**

Constructed to insure long life.

Superiority proven by years of experience.

Send for Bulletin C-5100

YEOMANS BROTHERS CO., 1421 Dayton St., Chicago, Ill.

Ross

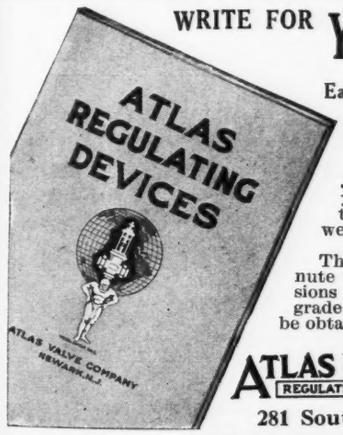
Surface Barometric and Jet Condensing Equipments for Power Plants.
Main, Auxiliary, Distilling Condensers & Evaporators for Marine Service.
Distilling Condensers for Refrigeration and Chemical Plants.

"Crosshead Guided" Expansion Joints.
Ross Boiler Feed Water Heaters.
Ross Oil and Sugar Juice Heaters.
Gravity & Forced Circulation Heaters.
Ross Oil, Air and Water Coolers.

ROSS HEATER & MFG. CO., Buffalo, N. Y.

THE BRAND THAT LEADING ENGINEERS DEMAND

WRITE FOR **YOUR COPY**



Each Reader of Heating and Ventilating is Entitled to a Copy of this Catalog

Just tear out this page, write your name and address on the margin, mail to us, and we will send you a copy.

This catalog describes in minute detail and gives all dimensions and prices of the highest grade regulating devices that can be obtained.

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

281 South St., Newark, N. J.

SOME SUBJECTS

B. T. U. Losses
Chimneys
Ducts and Flues
Fittings
Flow of Steam in Pipes
One Pipe Steam Systems
Vacuum Heating Systems
Vapor Heating Systems
Gravity Water Heating

Heating and Ventilation

STANDARD DATA SHEETS

198 Sheets Covering 25 Important Subjects
Price 5 Cents per Sheet

Send for folder giving full list and special prices on sets and binder.

HEATING AND VENTILATING MAGAZINE CO.
1123 Broadway New York City

GURNEY BOILERS RADIATORS

FOR HEATING ANY DESCRIPTION OF BUILDING BY STEAM OR HOT WATER

GURNEY HEATER MANUFACTURING CO.

HEAD OFFICE 188-200 FRANKLIN ST. BOSTON, MASS. SHOWROOMS NEW YORK-PHILADELPHIA-WASHINGTON

ADVERTISERS' INDEX

Alberger Heater Co..... 81
Alberger Pump & Condenser Co... 84
Allen Air-Turbine Ventilator Co.... 26
American Blower Co..... 73
American District Steam Co..... 17
American Radiator Co..... 61
American Steam Pump Co..... 84
Atlas Valve Co..... 97
Atmospheric Conditioning Corp.... 70

Badger & Sons Co., E. B..... 87
Banner Rock Products Co..... 86
Batterman-Truitt Co..... 67
Bayley Mfg. Co..... 80
Bishop & Babcock Co..... 18
Buckeye Blower Co..... 76
Buffalo Forge Co..... 71

Carrier Engineering Corp..... 91
Chicago Pump Co..... 88
Clarage Fan Co..... 2
Cleveland Gas Burner & Appliance Co 4
Commonwealth Brass Corp..... 22
Connersville Blower Co..... 3
Cox Stove Co., Abram..... 9
Crane Co..... 11

Dahlquist Mfg. Co..... 87
Davis Regulator Co., G. M..... 83
Detroit Lubricator Co..... 86
Dole Valve Co..... 69
Douglass & Co., Thomas J..... 78
Dunham Co., C. A..... 20

Economy Pumping Machinery Co..... 87
Excelso Specialty Works..... 95

Fleisher Co., W. L..... 23
Fulton Co..... 18

Gleockle, Jr., A. F..... 89
Gorton & Lidgerwood Co..... 16
Griscom-Russell Co..... 23
Gurney Heater Mfg. Co.....95, 97

Hackney Manufacturing Co..... 74
Haines & Co., Wm. S..... 83
Hartman Co., Chas..... 85
Healy-Ruff Co..... 81
Herbert Boiler Co..... 6
Hersh Bros. Co..... 72
Hoffman Specialty Co..... 100
Hornung, J. C..... 90

Ideal Heating Equipment Co..... 83
Ilg Electric Ventilating Co..... 68
Illinois Engineering Co..... 24
Illinois Malleable Iron Co..... 8
International Heater Co..... 12

Jenkins Bros..... 69
Johnson Service Co..... 26
Johns-Manville, Inc..... 69

Kennedy Valve Mfg. Co..... 21
Kewanee Boiler Co..... 5
Knowles Mushroom Ventilator Co.... 91

Landers, Frary & Clark..... 98

Marsh & Co., Jas P..... 3
Marsh Valve Co..... 83
Mason Regulator Co..... 97
Massachusetts Blower Co..... 80
McAlear Mfg. Co..... 24
McDonald Under-Seat Valve Co..... 21
Mellish-Hayward Co..... 78
Moline Heat..... 15

Nash Engineering Co..... 66
National Asbestos Mfg. Co..... 91
National Regulator Co..... 22
New York Blower Co..... 77

Ozone Pure-Airifier Co..... 13

Page Boiler Co., Wm. H..... 7
Patterson-Kelly Co..... 88
Plant Engineering & Equipment Co. 12
Powell Co., Wm..... 86
Powers Regulator Co..... 83

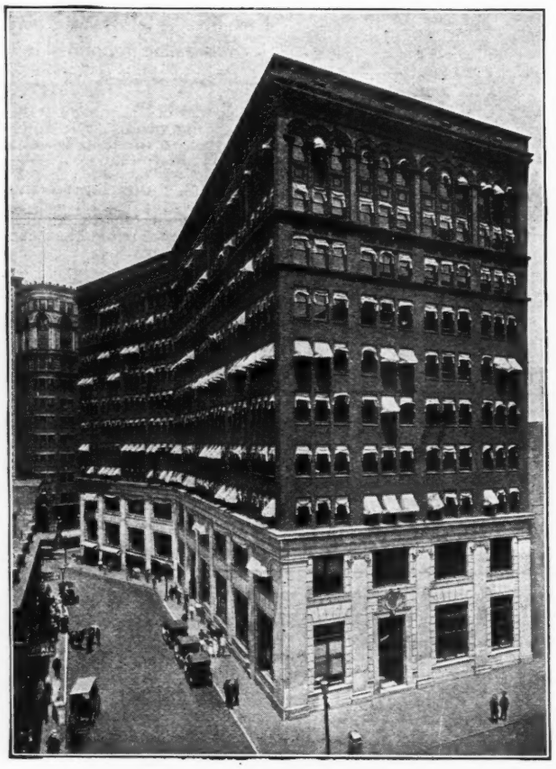
Ric-Wil Co.....Front Cover
Ross Heater & Mfg. Co..... 97

Sarco Co..... 19
Simmons Co., John..... 10
Sims Co., The..... 85
Sixth City Sheet Metal Works Co 82
Skinner Bros. Mfg. Co..... 99
Sprague Electric Works..... 80
Standard Heater Co..... 12
Sterling Engineering Co..... 85
Sturtevant Co., B. F..... 75

Taylor Instrument Cos..... 78
Thomas Pump Works..... 90
Thompson Mfg. Co..... 89
Titusville Iron Works Co..... 10
Toledo Pipe Threading Machine Co 89
Trane Co..... 14

United Vacuum Appliance Div..... 98
Utica Heater Co..... 93
Webster & Co., Warren..... 19
Westinghouse Elec. & Mfg. Co..... 79
Whitlock Coil Pipe Co..... 82
Wing Mfg. Co., L. J..... 81
Wright-Austin Co..... 20
Wyckoff & Son Co., A..... 90

Yeomans Bros Co..... 97
Young Pump Co..... 91



National City Bank, Cleveland
Graham, Anderson, Probst & White, Achts., Chicago

CONNERSVILLE
VACUUM CLEANING SYSTEMS

Eliminate the human factor—machines are ready for use at all times.

There are no tanks or buckets to clean out—to fill up and destroy the efficiency of the machine.

Dirt and dust are continually discharged directly into the sewer in a liquid condition.

Connersville cleaners are easy to install and simple to operate.

Automatic Disposal of all Dust and Dirt

LANDERS, FRARY & CLARK
U. V. A. Div., Dept. C CONNERSVILLE, IND.

"There is the Only Heater I Will Recommend"

The president was talking —

"There, gentlemen, is the only heater I will recommend for our new plant! We've tried every imaginable system, and each time we've had trouble of one kind or another. Last fall, though, I put in a Skinner Bros. (Baetz Patent) Heater, and now — well, our heating troubles are past! All of the plant is kept at the same even temperature all day long, the men are contented and healthy, they don't lose time 'warming up,' and our production is right up to schedule."

Simple and Economical

Due to unit construction, the heater is portable—requires no special foundations—installation cost is 15% to 50% lower than any other type—operating cost is equally low. No outside pipes or ducts required—performance strictly guaranteed.

Find out more about this heater. If you wish, we will send you names of users so you can make your own investigations.

Mechanical Details

Steam-Coil Type

Built as an individual enclosed unit with a series of pipe coils compactly mounted above a powerful fan-wheel. Coils are heated by exhaust or live steam. Cold air is drawn into the heater by the fan, impelled upward and around the coils, and, after being heated, is diffused through outlet hoods to every part of the open area. No pipes or ducts used. The fan is operated by any power available.

Direct-Fired Type

Where steam is not available, we supply our direct-fired type DF, which burns coal, coke or wood. Built on the same scientific principle as type SC. The fan is operated by any power available.

Skinner Bros. Mfg. Co., Inc.

1426 South Vandeventer Ave. St. Louis, Mo.

Boston.....455 Little Bldg.
Buffalo.....712 Morgan Bldg.
Cleveland.....622 Marshall Bldg.
Chicago.....1514 Fisher Bldg.
Indianapolis.....336 Occidental Bldg.
New York.....1712 Flatiron Bldg.
Minneapolis...812 Metropolitan Life Bldg.

Skinner Bros.
Baetz Patent HEATING SYSTEM

Skinner Bros. Mfg. Co., Inc.,
1426 S. Vandeventer Ave., St. Louis, Mo.

Please send complete details on Skinner Bros. (Baetz Patent) Heaters to

Firm .....

Address .....

Building used for.....

We can / cannot use steam.

YOU MUST HAVE EFFICIENCY AND ECONOMY IN A VALVE

as in Any Other Detail of Your Heating Plant

WHY HAVE EFFICIENT STEAM BOILERS AND RADIATORS

and an Inefficient Valve?

HENCE the valve is important enough to warrant your personal attention. Ask yourself, "What is the best venting valve on the market?" "Which one is a step or two in advance of all the others?" "Which one combines all the strength of the others and none of the weakness?" "Which one is the simplest?" "Which one is the most rugged in construction?" "Which one has the strongest manufacturer's guarantee?"

When you get the correct answer to all these questions, you'll specify the HOFFMAN, and it's the valve you and your clients have been looking for.

A New Special Catalog Has Been Prepared for the Engineer and Architect

No. 8 Hoffman Return Line Valve for Vacuum or Vapor Return Line Service.

HOFFMAN SPECIALTY COMPANY

Main Office and Factory
WATERBURY, CONN.

Boston
80 Boylston St.

Chicago
130 N. Wells St.

New York
512 Fifth Ave.

Los Angeles
405 S. Hill St.